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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 12, NUMBER 13
JULY 1, 1979

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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior

VOLUME 12, NUMBER 13
JULY 1, 1979

W79-06001--W79-06500

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the Bio-Science Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

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01 NATURE OF WATER
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02 WATER CYCLE
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03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

NUCLEATION AND GROWTH OF ICE CRYSTALS,
Rocketdyne, Canoga Park, CA.
J. Farrar, and K. Youel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-210 535, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 157, February 1966. 61 p, 17 fig, 7 tab, 32 ref. 14-01-0001-333.

Descriptors: *Nucleation, *Freezing, *Ice, *Catalysts, Chemical reactions, Crystal growth, Electrolytes, Drops(Fluids), Particle size, Emulsions, Sea water, Heat, Mass transport, Supercooling, Irradiation, Thermal conductivity, Separation techniques, Desalination.

Experimental techniques were used to observe the beginning of ice growth in water, and to study the catalytic effectiveness of chemical and mechanical nucleation stimuli. Nucleation rates were determined as functions of the sample size and sample source, the concentration of electrolytes and suspended matter, and the intensity of mechanical agitation. Conclusions were drawn in the following areas: behavior of bulk water, effect of particles, nucleation of water drops, and nucleation in water-oil emulsions. Ice nucleated heterogeneously in all experiments. Data from droplet and nucleation studies were compared with nucleation data obtained for octadecane and mercury and the predicted rates for homogeneous nucleation in water, and were found to be in agreement with the liquid-solid interfacial energies of these materials. This substantiates the Turnbull-Fisher theory of nucleation in condensed systems. (Davison-IPA)
W79-06425

2. WATER CYCLE

2A. General

THE EFFECT OF INTERCEPTED RAINFALL ON THE WATER BALANCE OF A HARDWOOD FOREST,
Montreal Univ. (Quebec). Dept. of Geography.
B. Singh, and G. Szeicz.
Water Resources Research, Vol 15, No 1, p 131-138, February 1979. 5 fig, 3 tab, 17 ref.

Descriptors: *Rainfall, *Interception, *Forests, *Water balance, Model studies, Mathematical models, On-site investigations, Evaporation, Evapotranspiration, Trees, Hardwood, Runoff, Soil water, Wetting, Drying, Canopy, Meteorology, Forest water balance, Intercepted rainfall.

Evaporation from a large hardwood forest was estimated from measurements of the required meteorological variables and from measured stomatal resistances. A correction factor was derived to overcome the incorrect assumption that evaporative demand remains the same during wet and dry periods. The factor was based on the ratio of the isothermal resistances during the wet and subsequent dry periods. The stomatal measurements were converted to canopy resistances by dividing by the leaf area index, and the stomatal measurements were used to obtain the water balance for the entire season. The results were analyzed to show that evaporation from a wet canopy is often 2-3 times greater than transpiration from the same surface. Rates of interceptional loss, calculated from the wet and dry evaporation rates, were verified by direct measurements of throughfall and stemflow. Net interceptional loss, equal to the excess evaporation from a wet canopy over a dry one, depended on rainfall duration and character and was on the average about 60-80% of total interception. In the overall summer water balance of 442 mm of precipitation and 52-mm depletion of soil storage, transpiration via the trees accounted for 261 mm, evaporation from the wetted leaves and branches for 111 mm, and runoff for 131 mm, giving an error of closure in the water balance of only 9 mm. If transpiration only had been used instead of interception when the canopy was wet, the error in the water balance would have been 100 mm. (Sims-ISWS)
W79-06072

TIME AND LENGTH SCALES FOR THE ONE-DIMENSIONAL ASSUMPTION AND ITS RELATION TO ECOLOGICAL MODELS,
Army Engineer Waterways Experiment Station, Vicksburg. Environmental Effects Lab.
For primary bibliographic entry see Field 2H.
W79-06073

WATER BALANCE ESTIMATE FOR GEORGIAN BAY IN 1974,
Canada Centre for Inland Waters, Burlington (Ontario).
W. M. Schertzer, E. B. Bennett, and F. Chiocchio.
Water Resources Research, Vol 15, No 1, p 77-84, February 1979. 3 fig, 5 tab, 21 ref.

Descriptors: *Water balance, *Bays, *Great Lakes, On-site investigations, Current meters, Currents(Water), Runoff, Precipitation(Atmospheric), Groundwater, Evaporation, Inflow, Discharge(Water), Water levels, Meteorological data, Hydrology, *Georgian Bay.

Current meter observations and hydrological and meteorological data collected primarily during 1974 formed the basis upon which the monthly water balance of Georgian Bay could be estimated. The data were used to derive a first approximation of the exchange of water between Georgian Bay and main Lake Huron. The net exchange across Main Channel at depths greater than 5 m was determined from extensive current meter observations, while the exchange in the upper 5 m was the residual necessary to achieve a balanced water budget. The results illustrate that during the stratified season (May through November), the transport of water through Main Channel is also stratified, with surface water moving into Georgian Bay from main Lake Huron; while continuity is maintained by net outflow at depths greater than 5 m. Total annual supply from runoff and direct precipitation is nearly twice as large as combined losses from evaporation and flow to North Channel. Residence and flushing times for water in the bay were estimated at 5.1 and 5.7 years, respectively. (Sims-ISWS)
W79-06076

GEOLOGIC APPLICATIONS OF LANDSAT IMAGES IN NORTHEASTERN ARIZONA TO THE LOCATION OF WATER SUPPLIES FOR MUNICIPAL AND INDUSTRIAL USES,
Arizona State Univ., Tempe. Dept. of Geology.
E. Babcock, P. Briggs, K. DeCook, L. Ethridge, and K. Foster.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 816, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Research Center, University of Arizona, Tucson, Project Completion Report, April 1979. 92 p, 32 fig, 8 tab, 97 ref. OWRT B-066-ARIZ(1). 14-34-0001-8060.

Descriptors: *Groundwater, *Remote sensing, Landsat, Lineaments, Arizona, Aerial photography.

There is an increasing need for dependable municipal and agricultural water supplies, in addition to supplies needed by the rapidly expanding, coal-fired power plants, in the Four Corners Region of the Southwest. It has been previously shown that well production in northern Arizona sandstone aquifers is enhanced by deep fracturing. If such fractures extend to the surface, corresponding fault patterns may provide a basis for exploration for additional water supplies. In this study, photolineaments of the entire northeast quadrant of Arizona were mapped from standard EROS Data Center false color Landsat composites. In addition, photolineaments were mapped using computer-enhanced Landsat imagery of two intensive study sites. A third source of geologic structure data were existing large scale lineament maps derived from aerial photography of the study sites. Several spatially-distributed parameters obtained from these maps, such as lineament density and well-to-lineament distance are mathematically correlated with water well survey data (specific capacity, specific conductance, transmissivity, and water temperature) within the study sites to establish the most useful combination of data for extension of 'lineament signatures' throughout the entire northeast quadrant. Results indicate that Landsat imagery may be used to survey large areas for lineaments, and to cue the hydrogeologist to promising regions, which can then be mapped at aerial photography scales.
W79-06164

APPLICATIONS OF RECURSIVE ESTIMATION TECHNIQUES TO TIME VARIABLE HYDROLOGICAL SYSTEMS,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2E.
W79-06251

INSTANTANEOUS UNIT HYDROGRAPH WITH NEGATIVE ORDINATES--POSSIBLE,
Technion - Israel Inst. of Tech., Haifa. Faculty of Industrial and Management Engineering.
For primary bibliographic entry see Field 2E.
W79-06257

INITIAL EFFECTS OF CLEARCUT LOGGING ON SIZE AND TIMING OF PEAK FLOWS IN A SMALL WATERSHED IN WESTERN OREGON,
Pacific Northwest Forest and Range Experiment Station, Corvallis, OR. Forest Sciences Lab.
For primary bibliographic entry see Field 2E.
W79-06260

HYDROLOGIC MONITORING IN THE AREA OF THE TENNESSEE-TOMBIGBEE WATERWAY, MISSISSIPPI-ALABAMA, FISCAL YEAR 1978,
Geological Survey, Jackson, MS. Water Resources Div.
J. D. Shell.
Geological Survey open-file report, March 1979. 154 p, 1 fig, 2 tab, 5 append.

Descriptors: *Hydrologic data, *Inland waterways, *Surface waters, *Groundwater, *Water quality, Aquifers, Well data, Water yield, Water levels, Hydrographs, Water level fluctuations, Streamflow, Flow rates, Sediment transport, Water analysis, Physical properties, Chemical properties, Mississippi, Alabama, *Tennessee-Tombigbee Waterway.

This report, the fifth in a series of data reports prepared at the request of the Corps of Engineers, presents data collected in a study of the hydrologic effects of the Tennessee-Tombigbee Waterway. Included in this report are hydrographs of 149 observation wells, analyses of water samples from 12 wells and 23 surface-water stations, daily discharge for three surface-water gaging stations, and daily summaries of water-quality monitor records at 3 surface-water sites. (Woodard-USGS)
W79-06311

HYDROLOGIC DATA, 1974-77, STOVEPIPE WELLS HOTEL AREA, DEATH VALLEY NATIONAL MONUMENT, INYO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
C. E. Lamb, and D. J. Downing.
Available from OFSS, USGS Box 25425, Fed. Ctr. Denver, CO. 80225, printed copy $3.25, microfiche $3.50. Geological Survey open-file report 79-203, January 1979. 19 p, 4 fig, 4 tab, 2 ref.

Descriptors: *Groundwater resources, *Observations wells, *Water levels, *Water quality, *Streamflow, Hydrologic data, Well data, Base flow, National parks, California, *Death Valley National Monument, *Stovepipe Wells Hotel area, Salt Creek.

Ground-water levels in most wells did not change significantly from 1974 to 1977 in the Stovepipe Wells Hotel area, California. The average water-level decline was less than 0.10 foot between August 1974 and August 1977 in 10 observation wells. Water-level contours show a depression centered on the two pumping wells, but this depression existed before the National Park Service started pumping its well. The chemical quality of the ground water is poor. Dissolved-solids concentrations in water samples ranged from 2,730 to 6,490 milligrams per liter. Analyses of water samples from two wells showed large changes in some constituents from 1976 to 1977. Streamflow in Salt Creek has been monitored since February 1974. Base flow is seasonal, being 0.10 to 0.20 cubic foot per second during the summer and as much as three times that amount during the winter. Two chemical analyses of water from Salt Creek, representing summer and winter flow conditions, show large differences for many constituents. (Woodard-USGS)
W79-06313

SIMPLE NON-LINEAR MODELS FOR THE COOLING OF WELL-MIXED RIVERS,
Vienna Univ. (Austria). Inst. of Meteorology and Geophysics.
P. Kahlig.
Water, Air, and Soil Pollution, Vol 10, No 1, p 61-70, July 1978. 5 fig, 3 tab, 8 ref.

Descriptors: *Water temperature, *Cooling, *Rivers, *Model studies, Mathematical models, Heat transfer, Mixing, Winds, Temperature, Thermal capacity, Depth, Evaporation, Thermal radiation, Equations, Well-mixed rivers.

Using the presently known data of the temperature dependence of the coefficient of heat exchange at an air-water interface, the non-linear equation governing the one-dimensional cooling of a well-mixed river was solved analytically. It turns out that the effects of non-linearity are negligible within the small parameter range occurring in hydrological applications, justifying the use of linear models in one-dimensional river temperature calculations (e.g., exponential method). It was shown that the frequently used assumption of an exponential decay of excess temperature represents an acceptable approximation. (Sims-ISWS)
W79-06396

THE WATERSHED INFLUENCE ON STORM RUNOFF IN SMALL NORWEGIAN RIVERS,
Norges Vassdrags- og Elektrisitetsvesen, Oslo.
E. Ruud, T. Tjomsland, and K. Nordseth.
Nordic Hydrology, Vol 9, No 5, p 277-292, 1978. 5 fig, 2 tab, 21 ref.

Descriptors: *Watersheds(Basins), *Storm runoff, *Correlation analysis, *Model studies, Mathematical models, Effects, Rivers, River flow, Storms, Floods, Runoff, Hydrographs, Rainfall, Regression analysis, Hydrology, *Norway.

A procedure to isolate and investigate the watershed influence on storm runoff was presented. It offers an opportunity to study also the change in influence of particular watershed characteristics by changing the input or soil moisture state of each catchment. Weighted lake area, area of bare rocks, main stream gradient, drainage density, and basin area were found to be the most significant characteristics in affecting peak runoff and time of rise on storm hydrographs in small Norwegian rivers. The intercorrelation structure of the watershed properties was examined. (Sims-ISWS)
W79-06406

THE DYNAMICS OF A DRAINAGE NETWORK,
Southampton Univ. (England). Dept. of Geography.
A. M. Gurnell.
Nordic Hydrology, Vol 9, No 5, p 293-306, 1978. 11 fig, 1 tab, 17 ref.

Descriptors: *Dynamics, *Drainage, *Watersheds(Basins), *Networks, Drainage density, Soil moisture, Precipitation(Atmospheric), Discharge(Water), Vegetation, Vegetation effects, Rocks, Runoff, Antecedent precipitation, Rainfall, Hydrographs, Storms, Storm runoff, Regression analysis, Hydrology.

The dynamics of the drainage network within a small catchment were studied in detail. Variations in the network were related both to transient characteristics of the catchment, including precipitation, soil moisture content, and discharge, and to more permanent characteristics including vegetation and rock type. (Sims-ISWS)
W79-06407

NEW EVALUATION OF THE ADVISABILITY OF SEPARATING THE EASTERN SHALLOWS OF THE NORTHERN CASPIAN,
Akademiya Nauk SSSR, Moscow. i Inst. Geografii.
For primary bibliographic entry see Field 2D.
W79-06413

CLIMATE,
California State Univ., Long Beach.
For primary bibliographic entry see Field 2B.
W79-06451

2B. Precipitation

A STATISTICIAN'S VIEW OF WEATHER MODIFICATION TECHNOLOGY (A REVIEW),
California Univ., Berkeley. Statistical Lab.
J. Newman.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A051 439, Price codes: A02 in paper copy, A01 in microfiche. Proceedings of the National Academy of Sciences, Vol 74, No 11, p 4714-4721, November 1977. 1 fig, 1 tab, 42 ref.

Descriptors: *Reviews, *Weather modification, *Statistical methods, *Technology, *Cloud seeding, *Methodology, *Analytical techniques, Precipitation(Atmospheric), Droughts, Testing procedures, Policy, Silver iodide, Randomization, Evaluation, Hail, Statistics.

Available evidence on effectiveness of weather modification techniques shows: (1) Present cloud seeding technology has not been reliably confirmed as a means of alleviating draught. (2) Although cloud seeding does affect precipitation and up to hundreds of kilometers beyond intended targets, effects vary from large increases to large decreases in precipitation. (3) Hypothetical mechanisms advanced to explain such effects differ in empirical support and plausibility, and much of existing literature (including from official sources) is slanted and unreliable. (4) At least two philosophically different interdisciplinary research groups, including statisticians, should be established to reevaluate data from experiments already performed, and to continue with properly planned experimentation. Suitable methodology is outlined, and established of a randomization center is recommended. This paper presents examples of contradictory conclusions from the same data, and conclusions derived from faulty methodology; for example, the historical regression technique has been shown to be unreliable, yet it continues to be used in analyzing field tests. Experiments and projects discussed include the Whitetop experiment, Swiss hail prevention experiment, cloud seeding in Arizona's Santa Catalina Mountains, Bureau of Reclamation's Skywater Conferences, Pyramid Lake experiment, Colorado River Basin Pilot Project, National Hail Research Experiment, and Florida Area Cumulus Experiment. (Lynch-Wisconsin)
W79-06045

CLOUD PHYSICS AND WEATHER MODIFICATION.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 740, Price codes: A07 in paper copy, A01 in microfiche. Translation of FIZIKA OBLAKOV I AKTIVNYKH VOZDEISTVII, 1967. Translated from Russian. Amerind Publishing Co., New Delhi, India. 1977. Levin, L.M. and Litvinov, I.V. (eds). 121 p, 23 fig, 9 tab, 98 ref.

Descriptors: *Weather modification, *Cloud physics, *Clouds, *Precipitation(Atmospheric), *Meteorology, *Raindrops, *Translation, *Foreign research, Condensation, Radar, Measurement, Cloud formation, Chemistry of precipitation, Cloud seeding, Model studies, Equations, Mathematical studies, Reflectivity, Supersaturation, Turbulence, Atmospheric pressure, Atmospheric physics, Atmosphere.

This collection of 10 articles deals with the influence of cloud drop formation on condensation nuclei, factors affecting drop growth, temporal stability of cloud radar reflectivity values, cloud redistribution over a limited area, relative norms of reagent discharge in weather modification, and a method for improving radar cloud measurement accuracy. Individual articles concern: (1) Gravitational coagulation of charged cloud drops in a turbulent medium, using a two-layer turbulence model. (2) Aspects of the theory of atmospheric condensation nuclei accompanied by a theoretical model, with proposal of a fluctuation mechanism of cloud drop formation. (3) Fluctuation of vapor concentration and magnitude of supersaturation in the atmosphere, including discussion of the influence of pressure fluctuation and the problem of smoothing the spectral function of supersaturation. (4) Condensation growth of drop on a hygroscopic nucleus, considered in the quasi-static approximation. (5) Calculation condensation growth time of a drop on a hygroscopic particle, taking into account influence of heat of condensation. (6) Redistribution of precipitation due to nucleation. (7) Temporal stability in radar reflectivity value, showing that its interrelationship with liquid precipitation intensity often changes during a storm. (8) Pressure of water vapor over solution. (9) Relative scale of dispensers in weather modification by crystallizable reagents in supercooled clouds. (10) Surface-active substances action on water drop evaporation. (Lynch-Wisconsin)
W79-06046

THE EFFECT OF INTERCEPTED RAINFALL ON THE WATER BALANCE OF A HARDWOOD FOREST,
Montreal Univ. (Quebec). Dept. of Geography.
For primary bibliographic entry see Field 2A.
W79-06072

MAXIMUM LIKELIHOOD ESTIMATION OF FOURIER COEFFICIENTS TO DESCRIBE SEASONAL VARIATIONS OF PARAMETERS IN STOCHASTIC DAILY PRECIPITATION MODELS,
Science and Education Administration, Fort Collins, CO.
D. A. Woolhiser, and G. G. S. Pegram.
Journal of Applied Meteorology, Vol 18, No 1, p 34-42, January 1979. 2 fig, 3 tab, 13 ref, 2 append. NSF GK-31521X.

Descriptors: *Precipitation(Atmospheric), *Rainfall, *Model studies, Mathematical models, Fourier analysis, Stochastic processes, Markov processes, Regression analysis, Equations, Optimization, Mathematics, Weather, Meteorology, Climatology.

Methods were investigated to obtain maximum likelihood estimates of the Fourier coefficients to describe the seasonal variability in the parameters for a stochastic rainfall model. Parameters were obtained from a two-state Markov chain model for wet and dry day occurrence, and from a mixed exponential model for distribution of depth on wet days. The procedure was demonstrated on 4 sample stations scattered across the continental United States. A constrained multivariate optimiz-

ation scheme and a simple univariate procedure were used for maximum likelihood estimation, and these were compared with a least-squares estimate. The two seasonally varying parameters for the Markov chain were mutually independent, but the Fourier coefficients for each parameter were weakly dependent. The 3 seasonally varying parameters in the mixed exponential distribution were mutually dependent. However, for the 4 precipitation records analyzed, it appears that acceptable results can be obtained by simultaneously estimating the constant series terms and then independently estimating the harmonic amplitudes and phase angles. A likelihood ratio test can be used to test the significance of each added harmonic. It also appears from this analysis that the significant Fourier coefficients can be plotted on maps as isopleths, providing a concise description of regional precipitation climatology. (Sims-ISWS)
W79-06238

URBANIZATION AND CHANGES IN PRECIPITATION, A STATISTICAL APPROACH,
Royal Netherlands Meteorological Inst., De Bilt.
T. A. Buishand.
Journal of Hydrology, Vol. 40, No. 3/4, p 365-375, February 1979. 3 fig, 6 tab, 5 ref.

Descriptors: *Precipitation(Atmospheric), *Rainfall, *Urbanization, Cities, Rural areas, Seasonal, Variability, Effects, Analytical techniques, Data processing, Statistics, Weather, Meteorology, *The Netherlands.

Monthly rainfall data from urbanized and rural areas in the western part of The Netherlands were used to investigate the urban effects upon the rainfall regime. A trend test in the sequence of differences between urban and rural rainfall amounts was described. For the urban areas of Amsterdam and Rotterdam, some evidence was found for an increase in precipitation. (Sims-ISWS)
W79-06248

VARIATIONS IN THE ACID CONTENT OF RAIN WATER IN THE COURSE OF A SINGLE PRECIPITATION,
Arizona Univ., Tucson. Dept. of Chemistry.
For primary bibliographic entry see Field 2K.
W79-06398

CLIMATE,
California State Univ., Long Beach.
J. C. Kimura.
In: A Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas, Vol 1, p 2-1 - 2-70, September 1974. 37 fig, 15 tab, 26 ref.

Descriptors: *Baseline studies, *Climate, *Cloud cover, *Hazards, Resources development, Environmental effects, Water resources, Precipitation, Coasts, *Outer Continental Shelf.

The immediate coastal zone of Southern California seaward to the western boundary of this study area (121 Meridian) is classified as belonging to the Mediterranean Dry Summer Subtropical climatic type, with a cool summer regime. Along the maritime fringe, temperatures are controlled by the sea. The warm month average is comfortably below 72F, while the cold month average is above 50F. Because of the moist air, the relative humidity at night is high, generally above 90%. As the temperature rises during the day, relative humidity decreases to about 60%. Precipitation is strongly concentrated in winter, with average annual values in the vicinity of 15 inches, decreasing over the sea and the immediate rain-shadows of the islands, and increasing over the coastal mountain slopes. Fewer than half of the days of the year are classed as cloudy (7/10 or more of the sky covered by clouds), and heavy fog averages 53 days per year at Los Angeles International Airport, decreasing to some 30 days at San Diego. The principal cloud type that contributes to low ceiling and restricted visibility in the Southern California Coastal and Offshore Region is stratus. The sea-surface temperature plays an essential role in the formation of stratus and fog over and near the ocean. In addition to its seasonality, there is a marked diurnal variation in the occurrence of stratus. As this cloud is advected inland a few miles by the sea breeze during the day, heat which the land absorbs evaporates the stratus, while the surrounding sea may be fogged in. (See also W79-06449) (Sinha-OEIS)
W79-06451

2C. Snow, Ice, and Frost

DELINEATION AND ENGINEERING CHARACTERISTICS OF PERMAFROST BENEATH THE BEAUFORT SEA,
Army Terrestrial Sciences Center, Hanover, NH.
P. V. Sellmann, E. Chamberlain, S. Arcone, S. Blouin, and A. Delaney.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XI, Hazards, p 50-74, October 1978. 7 fig, 2 tab. NOAA, Outer Continental Shelf Environmental Assessment Program. Boulder, Colorado. 01-5-022-2313.

Descriptors: *Permafrost, *Sediments, *Baseline studies, Environmental effects, Resources development, Oil spills, Water pollution, Alaska, *Outer Continental Shelf, *Engineering properties, Beaufort Sea, Petroleum development.

The objective of CRREL's subsea permafrost program is to obtain specific information on the distribution and engineering characteristics of permafrost beneath the Beaufort Sea. Observations include determinations of subsea sediment temperature, type, ice content, and chemical composition. The following conclusions were made: Ice-bonded sediments were encountered locally in the upper 10 m of sediment, in water depths of 2 m off the Sagavanirktok delta. The position of the bonded permafrost interface is extremely variable, as would be anticipated in a marginal permafrost zone. The distribution of bonded sediments is strongly related to engineering properties, primarily grain size and degree of initial ice saturation, as well as other factors such as water depth and transgressive and preinundation history of the area. It is not inconceivable that ice-bonded sediments can occur locally nearer the surface of the sea bed with increasing distance from shore. Fine-grained sand, silt and clay sediments occur near the sea bed to beyond Reindeer Island, and are as great as 10 m in thickness. Shallow, highly overconsolidated marine clays occur seaward and slightly shoreward of Reindeer Island in areas that have been studied. If the freeze-thaw mechanism is responsible for their formation, they could be found in many shallow water areas where fine-grained marine sediments occur. (Sinha-OEIS)
W79-06215

OFFSHORE PERMAFROST STUDIES, BEAUFORT SEA,
Geological Survey, Menlo Park, CA.
D. M. Hopkins, and R. W. Hartz.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XI, Hazards, p 75-147, October 1978. 1 fig, 10 append. NOAA, Outer Continental Shelf Environmental Assessment Program. Boulder, Colorado.

Descriptors: *Permafrost, *Hazards, *Drilling, *Baseline studies, Stratigraphy, Sea ice, Boreholes, Resources development, Environmental effects, Alaska, *Outer Continental Shelf, Beaufort Sea, Pollen chronology, Geothermal profiles, Radiocarbon dates, Petroleum development.

The main objective in this study is to obtain direct knowledge of offshore permafrost by drilling and thermally instrumenting boreholes in the Prudhoe Bay area. Utilizing sea ice as a drilling platform, four boreholes were drilled and cored during the spring of 1977. During 1977 drilling operations intact ice-bonded cores were recovered for the first time and it was established that ice-bonded permafrost is likely to be present within a few meters below the sea bottom at points as much as 17 km offshore. The 1977 boreholes also provide evidence of rapid thermokarst subsidence following initial submergence and they establish that Prudhoe Bay is the remnant of an ancient thaw lake that once extended to Gull Island Shoal. The report presented detailed data on stratigraphy, fossil content, radiocarbon dates, pollen chronology, and geothermal profiles. (Sinha-OEIS)
W79-06216

YUKON DELTA COASTAL PROCESSES STUDY,
Houston Univ., TX. Dept. of Geology.
For primary bibliographic entry see Field 5C.
W79-06219

SEISMIC AND VOLCANIC RISK STUDIES – WESTERN GULF OF ALASKA,
Alaska Univ., Fairbanks. Geophysical Inst.
For primary bibliographic entry see Field 5C.
W79-06221

SUBSEA PERMAFROST: PROBING, THERMAL REGIME AND DATA ANALYSIS,
Alaska Univ., Fairbanks. Geophysical Inst.
T. E. Osterkamp, and W. D. Harrison.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. XI, Hazards, p 570-650, October 1978. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-55.

Descriptors: *Hazards, *Permafrost, *Drilling, Baseline studies, Resources development, Environmental effects, Oil pollution, *Outer Continental Shelf, *Thermal regime, Petroleum development, Beaufort Sea, Chukchi Sea.

The objectives are to determine the distribution and properties of subsea permafrost in Alaskan waters. Besides direct measurements, the program includes an effort to understand the basic physical processes responsible for the subsea regime, as a basis for predictive models. Work has been carried out in both the Chukchi and Beaufort Seas, and the conclusions are stated separately for each. To develop proper precaution against potential problems a better understanding is needed for the horizontal and vertical distribution of subsea permafrost and permafrost and the processes that control this distribution. It should be emphasized that drilling data exist only near Barrow and Prudhoe Bay in the Beaufort Sea and that extrapolations to other areas must be highly speculative. For the present the concerns are for the safety of exploratory drilling, but the eventual objective is not only to find, but to produce hydrocarbons. At this stage, permafrost and hydrate conditions will be even more important since hot fluids in the well-bore are unavoidable. Thus, it is very important to maximize the derived downhole information at the initial stage of exploratory drilling. (Sinha-OEIS)
W79-06222

BEAUFORT SEACOAST PERMAFROST STUDIES,
Alaska Univ., Fairbanks. Geophysical Inst.
J. C. Rogers, and J. L. Morack.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. XI, Hazards, p 651-688, October 1978. 9 fig, 1 tab, 19 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulde, Colorado. 03-5-022-55.

Descriptors: *Permafrost, *Hazards, *Seismic studies, *Baseline studies, Resources development, Distribution, Environmental effects, Oil pollution, Alaska, *Outer Continental Shelf, Petroleum development, Beaufort Sea, Thermal models.

The known oil reserves along the Beaufort Sea coast coupled with a national need to develop these resources have focused attention on the distribution and character of permafrost in that area.

This study of coastal offshore permafrost utilizes seismic refraction techniques to probe the ocean bottom. The most important parameter to be determined is the distribution of offshore permafrost. Also, the depth to the top of the bonded permafrost beneath the ocean floor is to be determined. The distribution study has focused primarily on the Prudhoe Bay area with secondary emphasis at Point Barrow. The truncation of permafrost beneath the ocean is of interest, particularly the shape of the frozen-nonfrozen boundary. One import facet of the second objective is determining the nature and extent of the permafrost beneath the barrier islands. These results will provide valuable information for refinement and testing of thermal models as well as for determining operational methods for offshore oil and gas development. The third major objective is to provide information to support reconnaissance drilling programs. (Sinha-OEIS)
W79-06223

SEDIMENT TRANSPORT IN NORTON SOUND - NORTHERN BERING SEA, ALASKA,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 5C.
W79-06227

SEISMOTECTONIC STUDIES OF NORTHEAST AND WESTERN ALASKA,
Alaska Univ., Fairbanks. Geophysical Inst.
For primary bibliographic entry see Field 5C.
W79-06230

TRITIUM AND CARBON-14 DISTRIBUTIONS IN SEAWATER FROM UNDER THE ROSS ICE SHELF PROJECT ICE HOLE,
Scripps Institution of Oceanography, La Jolla, CA.
For primary bibliographic entry see Field 2L.
W79-06241

OCEAN TIDE AND WAVES BENEATH THE ROSS ICE SHELF,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2L.
W79-06242

CIRCULATION AND MELTING BENEATH THE ROSS ICE SHELF,
Lamont-Doherty Geological Observatory, Palisades, NY.
For primary bibliographic entry see Field 2L.
W79-06243

ROSS SEA REGION IN THE MIDDLE MIOCENE: A GLIMPSE INTO THE PAST,
Macquaries Univ., North Ryde (Australia). School of Biological Sciences.
For primary bibliographic entry see Field 2J.
W79-06244

ROSS ICE SHELF SEA TEMPERATURES,
New Zealand Oceanographic Inst., Wellington.
A. E. Gilmour.
Science, Vol. 203, No. 4379, p 438-439, February 2, 1979. 1 fig, 6 ref.

Descriptors: *Water temperature, *Sea water, *Antarctic, *Ice, Cold regions, On-site investigations, On-site data collections, Data processing, Temperature, Instrumentation, Equipment, Sampling, Melting, Circulation, Water circulation, Salinity, Oceanography, *Ross Ice Shelf.

Two temperature profiles recorded by a sensitive bathythermograph at the Ross Ice Shelf Project site (82 deg 22.5 min S, 168 deg 37.5 min W) were presented. From the shape of the profiles it was concluded that an inflow of water at intermediate depths provides a source of heat to drive a regime in which ice is melted from the interface at a depth of 360 meters. Melting maintains the temperature of a thick layer under the ice at about -2.14C, close to the ambient freezing temperature. A very well mixed layer about 35 meters thick was found at the seabed. (Sims-ISWS)
W79-06245

MIOCENE GLACIOMARINE SEDIMENTS FROM BENEATH THE SOUTHERN ROSS ICE SHELF, ANTARCTICA,
Northern Illinois Univ., De Kalb. Dept. of Geology.
For primary bibliographic entry see Field 2J.
W79-06246

THE ROSS ICE SHELF PROJECT,
Nebaska Univ., Lincoln. Ross Ice Shelf Project Management Office.
J. W. Clough, and B. L. Hansen.
Science, Vol. 203, No. 4379, p 433-434, February 2, 1979. 2 fig, 27 ref.

Descriptors: *Ice, *Antarctic, *On-site investigations, *Projects, Drill holes, Drilling, Biology, Marine biology, Oceanography, Temperature, Heat transfer, Currents(Water), Cold regions, On-site data collections, Reviews, *Ross Ice Shelf, Ice shelves.

A hole was drilled through the Ross Ice Shelf 450 kilometers from the barrier. Scientific sampling through this hole revealed a sparse population of crustaceans, fish, and microbial biomass. The seabed consists of mid-Miocene glaciomarine mud. Geothermal heat flow is average. Oceanographic data indicate an active circulation and melting at the base of the ice. (Sims-ISWS)
W79-06247

LAKE ERIE IN MID-WINTER,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2H.
W79-06403

2D. Evaporation and Transpiration

A COMPARISON OF TWO FORMULA TYPES FOR CALCULATING LONG-WAVE RADIATION FROM THE ATMOSPHERE,
Agricultural Research Service, Sidney, MT. Northern Plains Soil and Water Research Center.
J. K. Aase, and S. B. Idso.
Water Resources Research, Vol. 14, No. 4, p 623-625, August, 1978. 1 fig, 1 tab, 14 ref.

Descriptors: Radiation, Thermal radiation, Solar radiation, Air temperature, Humidity, Vapor pressure, Estimating equations.

Measurements of long-wave radiation at Sidney, Montana, indicated that both an analytically derived equation and an empirically derived equation for clear-sky conditions adequately predict the long-wave radiation flux at that site for screen level air temperatures above 0C. However, for air temperatures below 0C the analytical equation always underestimated the true radiation, while the empirical equation just slightly underestimated it, then matched it, and then overestimated it, as air temperature decreased from 0C to -37C. These discrepancies in the below 0C temperature regime indicated that the equations might need some modification to conform more closely to reality for low-temperature conditions. (Skogerboe-Colorado State)
W79-06029

EVAPOTRANSPIRATION FROM DOUGLAS FIR STANDS EXPOSED TO SOIL WATER DEFICITS,
British Columbia Univ., Vancouver. Dept. of Soil Science.
T. A. Black.
Water Resources Research, Vol. 15, No. 1, p 164-170, February 1979. 11 fig, 3 tab, 23 ref.

Descriptors: *Evapotranspiration, *Douglas fir trees, *Soil water, Root zone, Trees, Water balance, Energy budget, On-site investigations, Radiation, Solar radiation, Evaporation, Drying, Water storage, Vegetation, Vegetation effects, Forests, Moisture deficit, Analytical techniques.

The rate of evapotranspiration from thinned and unthinned stands of Douglas fir was measured using energy and water balance methods. At high values of soil water storage in the root zone, the evapotranspiration rate was approximately 80% of the equilibrium evaporation rate. Below a critical value of soil water storage, the ratio of the evapotranspiration rate to the equilibrium evaporation rate (E/E sub eq) tended to decrease linearly with decreasing soil water storage. The critical values of soil water storage in the root zone were 11.8 and 8.3 cm for the thinned and unthinned stand, respectively. Below these critical storage values, there was approximately 3.5 cm of water remaining in both root zones that was extractable by the trees. The relationship between E/E sub eq and the fraction of extractable water in the root zone for both stands was very similar for sunny days. In this relationship, E/E sub eq began to decrease when there was approximately 40% of the extractable water remaining in the root zones of both stands. (Sims-ISWS)
W79-06068

ENERGY BUDGET EVALUATION OF THE TRANSPIRATION-PF RELATIONSHIP IN A YOUNG PINE FOREST,
West Virginia Univ., Morgantown. Div. of Forestry.
S. Tajchman, F. Hadrich, and R. Lee.
Water Resources Research, Vol. 15, No. 1, p 159-163, February 1979. 3 fig, 3 tab, 15 ref.

Descriptors: *Evapotranspiration, *Forests, *Pine trees, *Energy budget, Radiation, Heat, Water loss, Temperature, Winds, Humidity, Clouds, Rainfall, Weather data, Data processing, Analytical techniques.

By using the Bowen ratio method, hourly and daily evapotranspiration totals were determined during a drying period for a 9-year-old pine forest situated in the upper Rhine area of Germany. A relationship between the soil water suction, expressed by pF, and the ratio Q of the latent heat of evapotranspiration to the available energy was obtained. For pF between 2 and 3, Q = 0.6, and for pF more than 3, Q decreases exponentially when pF increases. For pF = 4.2, Q = 0.11. These and other empirical and theoretical results suggested that the Q-pF relationship can be useful for calculating evapotranspiration from complex terrain situations where the micrometeorological approach is inapplicable. (Sims-ISWS)
W79-06069

CLIMATOLOGICAL ESTIMATES OF LAKE EVAPORATION,
Department of the Environment, Ottawa (Ontario). Hydrology Research Div.
F. I. Morton.
Water Resources Research, Vol. 15, No. 1, p 64-76, February 1979. 6 fig, 5 tab, 15 ref.

Descriptors: *Arizona, *Oklahoma, *California, *Nevada, *Canada, *Lake Ontario, Evaporation, *Energy budget, Climatology, Transpiration, Temperature, Humidity, Radiation, Environment, *Lake evaporation, *Areal evaporation, *Nile River, *Lake Hefner(CA), *Salton Sea, *Dauphin Lake(MB), *Lake Mead, Areal transpiration, Annual lake evaporation, Sunshine, Land environment.

A model for estimating areal evaporation and transpiration was modified slightly to provide estimates of annual lake evaporation from monthly observations of temperature, humidity, and sunshine duration (or radiation) in the land environment. The model estimates were higher than the more conventional estimates in humid areas and lower in arid areas, with the latter tendency particularly noticeable in the case of Lake Nasser on the Nile River. However, the results agreed very well with comparable water budget estimates for

Lake Hefner in Oklahoma, the Salton Sea and Silver Lake in California, Pyramid Lake in Nevada, Lake Ontario, and Dauphin Lake in Manitoba. The model results also compared reasonably well with energy budget estimates of the evaporation from Lake Mead on the border between Arizona and Nevada when the net inflow of heat was taken into account. A technique that provided such realistic results over a wide range of depths and environments with readily available data proved useful in water resource or environmental impact studies. Examples of such uses were provided by maps of Canada and the southeastern United States and showed average annual values of the lake evaporation, average values of the difference between the evaporation from a projected reservoir, and the combined evaporation and transpiration from the area before flooding. (Roberts-ISWS)
W79-06261

ROLE OF EVAPORATION IN SPRINGTIME RUNOFF LOSSES IN THE DRAINAGE BASINS OF THE FOREST ZONE OF THE EUROPEAN USSR,
O. I. Krestovskiy, and A. G. Sergeyeva.
Soviet Hydrology: Selected Papers, Vol. 16, No. 2, p 93-97, 1977. 2 fig, 2 tab, 11 ref. Translated from Trudy Gosudarstvennogo Gidrologicheskogo Instituta, No. 233, p 79-86, 1977.

Descriptors: *Evaporation, *Snowmelt, *Runoff, Floods, Melt water, Snow, Surface waters, Soil water, Drainage, Watersheds(Basins), Flood forecasting, On-site investigations, On-site data collections, Evaporation pans, Melting, Water loss, *USSR.

Evaporation during the spring flood takes place from the surface of the snow, from water at the surface of a basin, and from snow-free soil. Total evaporation from the date of establishment of the maximum water equivalent of snow to the date of snow disappearance, i.e., during the period of runoff formation at the surface of drainage basins, averages 30-50 mm in the lowland area of the forest zone of the European USSR and varies by years and basins from 15 to 60 mm. Evaporation accounts for 30-60% of the total spring water losses, or 15-25% of the total water equivalent by the beginning of snow melting and precipitation during the runoff-forming period in spring. Daily total evaporation from more than 30% wooded basins averages about 1.0 mm/day and varies little from year to year. Therefore, total evaporation is determined in many respects by the duration of the runoff-forming period, i.e., the period of snow melting in forests, which depends to a large extent on the water equivalent. The presence of an indirect relation between total evaporation and the water equivalent of snow makes it possible to precalculate water losses through evaporation. In existing methods for the long-range forecasting of the spring runoff volume, the losses of water through evaporation are taken into account automatically, since the water equivalent of snow is the main argument in all prognostic relations. (Sims-ISWS)
W79-06409

NEW EVALUATION OF THE ADVISABILITY OF SEPARATING THE EASTERN SHALLOWS OF THE NORTHERN CASPIAN,
Akademiya Nauk SSSR, Moscow. i Inst. Geografii.
R. V. Nikolayeva, and R. Ye. Pereslegina.
Soviet Hydrology: Selected Papers, Vol 16, No 2, p 163-168, 1977. 9 tab, 18 ref. Translated from Izvestiya Akademii Nauk SSR, Seria Geograficheskaia, No 6, p 49-56, 1977.

Descriptors: *Water loss, *Evaporation, *Shallow water, Coasts, Wind tides, Winds, Water levels, Precipitation(Atmospheric), Hydrologic budget, Dams, Wetlands, *USSR, *Caspian Sea.

From refined computations of irreversible water losses through evaporation from the temporarily flooded coastal belt and from estimates of the possible savings in the hydrologic budget of the sea after separation of the shallows, it was concluded that it is inadvisable to construct dams to reduce the water area of the Northern Caspian. (Sims-ISWS)
W79-06413

A PARAMETERIZATION OF THE EVAPORATION FROM NONSATURATED SURFACES,
Commonwealth Scientific and Industrial Research Organization, Mordialloc (Australia). Div. of Atmospheric Physics.
I. J. Barton.
Journal of Applied Meteorology, Vol 18, p 43-47, January 1979. 2 fig, 15 ref.

Descriptors: *Parametric hydrology, *Evaporation, *Surfaces, Radiation, Moisture content, Temperature, Air temperature, Variability, Moisture, Soil moisture, *Unsaturated surfaces, Net radiation, Constants, Variables, Moisture availability, Open grassland surfaces, Near-surface soil moisture.

The parameterization of evaporation proposed by Priestley and Taylor was modified to take account of nonsaturated surfaces. It was suggested that evaporation could be expressed as a function of net radiation, air temperature, a constant related to the nature of the surface, and a variable that was dependent on moisture availability. The constant was equal to 1.26 for water and open grassland surfaces, but was nearer unity for some other surfaces. The variable was found to be directly related to near-surface soil moisture content for both bare and grassland surfaces. (Roberts-ISWS)
W79-06422

2E. Streamflow and Runoff

FORECASTING SEASONAL SNOWMELT RUNOFF: A SUMMARY OF EXPERIENCE WITH TWO MODELS APPLIED TO THREE DRAINAGES IN THE CASCADE MOUNTAINS OF WASHINGTON,
Washington Univ., Seattle. Dept. of Civil Engineering.
D. P. Lettenmaier, and T. J. Waddle.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 656, Price codes: A06 in paper copy, A01 in microfiche. Charles W. Harris Hydraulics Laboratory Technical Report No. 59, November 1978. 104 p, 27 fig, 8 tab, 29 ref. OWRT B-071-WASH(2). 14-34-0001-7199.

Descriptors: *Runoff forecasting, *Snowmelt, Stochastic hydrology, Optimization, Reservoir operation, Watersheds.

Two alternative approaches to forecasting seasonal runoff volumes from watersheds with substantial snow storage were investigated. In the first, a continuous simulation model developed by the National Weather Service River Forecast Center in Sacramento, California was applied to the Cedar River, Washington. Although the model had proved quite successful in forecasting runoff from several California Sierra Nevada streams, the model could not be successfully calibrated for use in forecasting Cedar River runoff. Problems were traced to the snowpack accumulation and ablation module of the model; adequate performance of the land module was observed as evidenced by successful simulation of runoff events during seasons of the year with minimum snow water storage. The principal difficulties with the snowpack module appeared to be (1) use of the saturated adiabatic lapse rate for temperature computation regardless of weather conditions, (2) an unrealistically low partition temperature for discrimination between precipitation falling as rain and snow, (3) the method of computation of cloud cover for modification of solar radiation reaching the snowpack, (4) unrealistically low wind movement required to calibrate the condensation melt portion of the snowpack module, and (5) possible underestimation of the free water retention in the snowpack. The second approach employed was a modification of Tangborn's (1977) basin storage accounting approach, in which parameters are estimated by regression. The model was applied to three Washington streams: the Cedar, American and Stehekin Rivers. Inclusion of the snow course data substantially improved the accuracy of the Cedar River forecasts, substantially decreased the accuracy of the Stehekin River forecasts, and made little difference to the American River forecasts. Forecasts had little value beyond about March 15 for all the basins and had negative value to the Stehekin River forecasts. Increased precipitation forecast worth was observed for early winter runoff forecasts.
W79-06047

INCORPORATION OF FORECASTED SEASONAL RUNOFF VOLUMES INTO RESERVOIR MANAGEMENT,
Washington Univ., Seattle. Dept. of Civil Engineering.
S. J. Burges, and K. Hoshi.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 655, Price codes: A05 in paper copy, A01 in microfiche. Charles W. Harris Hydraulics Laboratory Technical Report No. 58, November 1978. 92 p, 7 fig, 8 tab, 65 ref. OWRT B-071-WASH(1). 14-34-0001-7199.

Descriptors: *Snowmelt, Stochastic hydrology, Optimization, Reservoir operation, *Runoff forecasting, Regression analysis.

The forecasting approaches can be classified as regression methods, pseudo water balance methods, and water balance methods. The major effort of this report focused on disaggregating predicted total seasonal runoff volumes to yield conditional probability distributions of flow in each month of the total forecast period. These conditional distributions were used as principal input data to a reservoir operation model. Forecasts of total snowmelt seasonal runoff volumes were used to determine operating rules for hypothetical reservoirs to determine the relative advantage of using forecasted flow over the unconditional flow state. Comparisons were made using chance constrained linear programming (CCLP) formulations for the operation of a single multiple purpose reservoir with and without snowmelt runoff forecasts. Two reservoir sizes, one approximately 20% and the other 100% of the mean annual flow volume of a river, were examined. Flow data from the Cedar River, Washington, were used to reflect runoff patterns typical of much of the Pacific Northwest region. Conditional streamflow distributions for months March-August were developed for given total March-August runoff volume amounts. These conditional distributions were used to develop Linear Decision Rules (LDR's) for the release from the reservoir. Economic benefits were computed for maximum ignorance operating rules (Type A), Type A operating rules with conditional inflows (Type B) and LDR's and benefits based on the conditional flows (Type C). Generally, under Type C operation there was less uncertainty in the cumulative distributions of water supply and reservoir freeboard (surrogate for flood control) than when Type A operation was used.
W79-06048

DISPERSION OF SOLUBLE POLLUTANTS IN NON-UNIFORM RIVERS, I. THEORY,
Commonwealth Scientific and Industrial Research Organization, North Ryde (Australia).
For primary bibliographic entry see Field 5B.
W79-06065

DISPERSION OF SOLUBLE POLLUTANTS IN NON-UNIFORM RIVERS, II. APPLICATION TO EXPERIMENTAL RESULTS,
Commonwealth Scientific and Industrial Research Organization, North Ryde, (Australia).
For primary bibliographic entry see Field 5B.
W79-06066

AN OBJECTIVE CRITERION FOR THE SELECTION OF REPRESENTATIVE BASINS,
Ibadan Univ. (Nigeria). Dept. of Geography.

F. S. Ebisemiju.
Water Resources Research, Vol. 15, No. 1, p 148-158, February 1979. 6 fig, 5 tab, 28 ref.

Descriptors: *Watersheds(Basins), *Africa, *Basins, *Drainage patterns(Geologic), *Geomorphology, Rivers, River basins, Drainage, Geology, Channel morphology, Channels, Classification, Hydrology, *Nigeria.

The existence of a hydrologically uniform area is questionable. Therefore, it is unlikely that a drainage basin can truly represent the diverse environmental and terrain conditions in any given area. The widely documented strong association between basin morphometry and hydrological responses indicates the possibility of identifying hydrologically similar basins on the basis of similarity of their gross morphology. By using a multidimensional, morphological classification of drainage basins, a rational basis for the selection of representative basins was developed. The procedures for this classification and selection were outlined and illustrated with an example from southeastern Nigeria. (Sims-ISWS)
W79-06070

ENTROPY CONCEPTS IN FLUVIAL GEOMORPHOLOGY: A REEVALUATION,
Lincoln College, (New Zealand). Tussock Grasslands and Mountain Lands Inst.
B. W. Davy, and T. R. H. Davies.
Water Resources Research, Vol. 15, No. 1, p 103-106, February 1979. 1 fig, 25 ref.

Descriptors: *Geomorphology, *Entropy, *Analytical techniques, *Fluvial sediments, Meanders, Channels, Channel morphology, Thermodynamics, Data processing, Mathematical models, Hydrology, Fluvial geomorphology.

The thermodynamic basis of entropy concepts as applied in fluvial geomorphology was examined closely. It was shown that the principle of minimum entropy production rate and the principle that the most probable state of a system is that which corresponds to a maximum of entropy are not applicable in stream situations. It was concluded that the use of entropy as an approach to stream behavior and sediment transport is of dubious validity. (Sims-ISWS)
W79-06074

DISSOLVED IRON--AN INDICATOR OF THE GROUNDWATER COMPONENT OF SMALL STREAMS DRAINING A GRANITE TERRAIN, SOUTH CAROLINA,
South Carolina Univ., Columbia. Dept. of Geology.
I. Kheoruenromne, and L. R. Gardner.
Water Resources Research, Vol. 15, No. 1, p 15-20, February 1979. 5 fig, 1 tab, 19 ref.

Descriptors: *Dissolved solids, *Iron, *Streams, *Groundwater, *South Carolina, On-site data collections, Model studies, Mathematical models, Streamflow, Runoff, Groundwater movement, Forests, Vegetation, Vegetation effects, Flow, Temporal distribution, Water quality, Hydrology.

The flow and dissolved iron content of two small streams draining a woodland basin and a recently deforested basin on a granite pluton in Kershaw County, South Carolina, were measured biweekly from September 1974 through August 1975. During spring and summer, the flow of the stream draining the deforested basin was reduced relative to that of the woodland basin because of the higher transpiration associated with rapid biomass accumulation by the newly established vegetation in the deforested basin. The observed relative reduction in flow was accompanied by a relative increase in iron concentration in the flow from the deforested basin. Analysis of the data also indicated that the rate of export of dissolved iron from both basins is independent of stream discharge. These observations suggested that the dissolved iron content of these streams is controlled by the dilution of iron-rich groundwater by essentially iron-free surface runoff and shallow interflow. A simple mixing model based on this hypothesis was developed and was found to fit the data. (Sims-ISWS)
W79-06078

CONSTRUCTION OF MODELS FOR FORECASTING AND CONTROLLING WATER QUALITY IN A RIVER BASIN ON PRINCIPLES OF SELF-ORGANIZATION,
Akademiya Nauk URSR, Kiev. Inst. Kibernetiki.
A. G. Ivakhenko.
In: American Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Kharkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 127-152, September 1978. EPA-600/9-78-024. 4 fig, 11 tab, 32 ref.

Descriptors: *River basins, *Forecasting, *Water quality, *Mathematical models, *Self-organization, *River flow, Annual, Monthly, Regression analysis, Equations, Systems analysis, Chlorides, Dissolved oxygen, Management, Reservoirs, Optimization, Discharge(Water), Harmonic trend, Optimum complexity, Dnieper River(USSR), Lagrangian polynomial, Linear polynomial.

The purpose of the research reported herein is to create mathematical models which adequately describe the dynamics of river basins and which are applicable both for forecasting and for deliberately changing and controlling the basins. Self-organization methods are considered the most promising mathematical models for identifying and controlling such systems. Work in this field from 1971 to 1975 was conducted at the Institute of Cybernetics of the Academy of Sciences, of the Ukraine. Construction of forecasting models for river basins developed for management purposes was also obtained at the VNIIVO Institute of the USSR Ministry of Land Reclamation and Water Use. Considered herein are: synthesis of models of the principle of self-organization; mathematical models for forecasting river flow; long-term forecast of the average annual flow of the Dnieper River; mathematical models for forecasting the quality of river water; and methods of managing the discharge of power plant reservoirs. Examples of methodological application are given, including forecasting of river flow with accuracy around 20%. Synthesis of the dynamics equations of the hydroelectrical power station discharge water reservoirs and the loss functions are shown. The equations obtained were used for synthesis of two-criteria management of the hydroelectric power station discharge in accordance with the ideas of multicriteria optimization. (See also W79-06166) (Bell-Graf--Cornell)
W79-06171

APPLICATIONS OF RECURSIVE ESTIMATION TECHNIQUES TO TIME VARIABLE HYDROLOGICAL SYSTEMS,
Institute of Hydrology, Wallingford (England).
P. G. Whitehead.
Journal of Hydrology, Vol. 40, No. 1/2, p 1-16, January 1979. 5 fig, 1 tab, 16 ref.

Descriptors: *Time series analysis, *Methodology, *Model studies, *Hydrologic systems, Rainfall-runoff relationships, River systems, Hydrology, Optimization, Equations, Mathematical models, Rivers, Algorithms, *Recursive estimation techniques, Time variable hydrological system, Maximum likelihood algorithms.

A flexible methodology was illustrated. The methodology used the recursive instrumental variable approximate maximum likelihood algorithms of time-series analysis to identify parameter variations and to characterize time-varying hydrological systems. The approach was developed for a single-input--single-output rainfall--runoff process and was extended to the multivariable situation for a river water quality system. (Lee-ISWS)
W79-06251

MODELING ALLUVIAL CHANNEL BED TRANSIENTS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W79-06252

EFFICIENT SIMULATION OF NONLINEAR STEADY FLOW,
Hawaii Univ., Honolulu. Dept. of Ocean Engineering.
G. Niemeyer.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY3, Proceedings Paper 14420, p 185-195, March 1979. 3 fig, 12 ref, 2 append. NSF DES74-23005.

Descriptors: *Steady flow, *Rivers, *Model studies, Mathematical models, Computer models, Computer programs, Simulation analysis, Numerical analysis, Hydrodynamics, Finite element analysis, Equations, Flow, Hydraulics.

Numerical simulation of steady flow can require considerable computation. However, unique features of finite element and finite difference methods can be exploited, which leads to an efficient solution procedure. Although the resulting technique is fundamentally a time-stepping method, it achieves convergence within only a few steps. The considerable computational advantages of the method were obtained, moreover, without sacrificing the rigor of the governing equations, which were solved in their full nonlinear form. The technique was developed specifically for the vertically integrated Navier-Stokes equations. It was applied to simulate steady river flow. (Sims-ISWS)
W79-06253

INSTANTANEOUS UNIT HYDROGRAPH WITH NEGATIVE ORDINATES--POSSIBLE,
Technion - Israel Inst. of Tech., Haifa. Faculty of Industrial and Management Engineering.
A. Boneh, and A. Golan.
Water Resources Research, Vol 15, No 1, p 121-130, February 1979. 7 fig, 21 ref.

Descriptors: *Unit hydrographs, *Runoff, *Hydrology, Hydrography analysis, Equations, Mathematical studies, Mathematics, Surface runoff, Flow, Time, Precipitation excess, Storm runoff.

The answer to the question posed in the title of this paper is yes, provided that some restrictions are imposed on the rainfall excess which is the input to the surface runoff system. Obviously, impulsive inputs are not admissible when the instantaneous unit hydrograph (IUH) has negative ordinates, since the IUH is the direct surface runoff response (known as the 'output') to an instantaneous rainfall burst of unit volume and such runoff, by definition, cannot be negative. Is an instantaneous unit hydrograph with negative ordinates (IUHWNO) desirable. Now the answer is no, because of the restrictions that have to be imposed on the input. The purpose of this paper was not to justify the assumption of linearity, an assumption which is open to serious doubts, but rather to point out that IUHWNO can be of value if and when linearity of surface runoff systems is assumed. Two problems were considered: (1) The first is the ability of an IUHWNO to represent a real-world surface runoff system. A 'degenerate IUH' does not have this ability, and hence the term 'nondegenerate IUH' was carefully defined in the paper. Several conditions were derived in the paper which enable decision as to the degeneracy of a given IUHWNO. (2) The second problem is the determination of the class of admissible inputs in a surface runoff system which is represented by a given nondegenerate IUHWNO. These two problems are relevant to whether or not one should explicitly introduce nonnegativity sign constraints into the IUH ordinates in the identification of a surface runoff system from input-output records. Possible extensions to nonlinear and time-varying systems were considered in the paper for continuous or discrete-time systems. (Lee-ISWS)
W79-06257

A GEOMORPHIC MODEL FOR USE IN STREAMFLOW ROUTING,
Tennessee Valley Authority, Knoxville.
R. P. Betson.
Water Resources Research, Vol. 15, No. 1, p 95-101, February 1979. 4 tab, 24 ref.

Descriptors: *Streamflow, *Routing, *Geomorphology, *Model studies, Mathematical models, Regression analysis, Watersheds(Basins), Discharge(Water), Channels, Channel flow, Flow, Sediments, Sediment transport, Hydrology, Hydraulics.

Regression equations were presented for predicting parameters in the geomorphic equations that relate streamflow discharge at a site to channel width and cross-sectional area (from which velocity and hydraulic depth can be determined). Two measures were used in these regression equations, drainage area and channel slope, both of which were obtained from topographic maps. Regeneration and simulation tests at stream gage sites located in the Cumberland Plateau Physiographic Province indicated that at higher flows, this system of equations can predict width and area within about 25% about 2/3 of the time. These results appear to be comparable with or better than results that would normally be obtained from the reconnaissance field surveys normally used in streamflow routing for planning-level applications. (Sims-ISWS)
W79-06259

INITIAL EFFECTS OF CLEARCUT LOGGING ON SIZE AND TIMING OF PEAK FLOWS IN A SMALL WATERSHED IN WESTERN OREGON,
Pacific Northwest Forest and Range Experiment Station, Corvallis, OR. Forest Sciences Lab.
R. D. Harr, and F. M. McCorison.
Water Resources Research, Vol. 15, No. 1, p 90-94, February 1979. 4 fig, 3 tab, 13 ref. NSF DEB74-20744 A06.

Descriptors: *Peak discharge, *Oregon, *Watersheds(Basins), *Lumbering, Forest watersheds, Snowmelt, Hydrology, Storm runoff, Model studies, Flow, Snow, Trees, *Clearcut logging.

Size of annual peak flow in a small watershed in western Oregon was reduced 32%, and average delay of all peak flows was nearly 9 hours following clearcut logging. Size of annual peak flows caused by rain with snowmelt was reduced 36%, and peak flows resulting from rain with snowmelt were delayed an average of nearly 12 hours following logging. Changes were attributed mainly to differences in short-term accumulation and melting of snow. No significant changes were detected in size or timing of peak flows that resulted from rainfall alone. (Lee-ISWS)
W79-06260

DESIGN MODEL FOR THERMAL EFFLUENTS IN RIVERS,
Italian Electrical Power Agency, Pisa. Thermal and Nuclear Research Centre.
For primary bibliographic entry see Field 5B.
W79-06267

FEDS PUSH FOR WHOLLY INTEGRATED STATE/EPA PROGRAMS,
For primary bibliographic entry see Field 5G.
W79-06297

LOW-FLOW FREQUENCY OF MINNESOTA STREAMS,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-06321

SPATIAL CORRELATION OF HYDROLOGIC AND PHYSIOGRAPHIC ELEMENTS,
Swedish Meteorological and Hydrological Inst., Norrkoping.
L. Gottschalk.
Nordic Hydrology, Vol 9, No 5, p 267-276, 1978. 2 fig, 8 ref.

Descriptors: *Hydrologic aspects, *Physiographic provinces, *Correlation analysis, *Model studies, Mathematical models, Rivers, Flow, River flow, Topography, Precipitation(Atmospheric), Runoff, Drainage, Hydrology.

In an earlier paper analytical expressions were given for the time correlation of hydrologic processes from the linearized equations of motion for these processes. In this paper, space correlation was treated similarly. Comparison was made with empirical space correlation functions of hydrologic and physiographic elements. (Sims-ISWS)
W79-06405

THE WATERSHED INFLUENCE ON STORM RUNOFF IN SMALL NORWEGIAN RIVERS,
Norges Vassdrags- og Elektrisitetsvesen, Oslo.
For primary bibliographic entry see Field 2A.
W79-06406

THE DYNAMICS OF A DRAINAGE NETWORK,
Southampton Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 2A.
W79-06407

COMPUTATION AND FORECAST OF THE SPRINGTIME FLOOD VOLUME IN THE VYATKA RIVER,
O. I. Krestovskiy.
Soviet Hydrology: Selected Papers, Vol 16, No 2, p 87-92, 1977. 3 fig, 2 tab, 7 ref. Translated from Trudy Gosudarstvennogo Gidrologicheskogo Instituta, No 233, p 15-26, 1977.

Descriptors: *Runoff, *Floods, *Flood forecasting, *Model studies, Mathematical models, Snowmelt, Precipitation(Atmospheric), Spring, Melt water, Soil water, Rivers, Forecasting, Flow, Flood discharge, *USSR, *Vyatka River(USSR).

A method for computing and forecasting springtime water losses and runoff depth during the flood period and the second quarter for the Vyatka River basin was described. It was developed on the basis of network observations of the Hydrometeorological Service over the period of 1936-1974. The proposed method is effective and based on the use of the autumn-winter river runoff and the depth of soil freezing in the field as indicators of the water storage capacity of the basin in spring. However, use of normal precipitation instead of actual precipitation for runoff forecasting reduces the effectiveness of the proposed method, since precipitation during the snow melting period can be smaller or greater by a factor of 3 than normal precipitation and runs off the entire basin with a runoff coefficient of 0.8-1.0. Therefore, the further improvement of forecasts of the spring runoff volume of the Vyatka River must be directed toward improving the method of forecasting spring precipitation. (Sims-ISWS)
W79-06408

ROLE OF EVAPORATION IN SPRINGTIME RUNOFF LOSSES IN THE DRAINAGE BASINS OF THE FOREST ZONE OF THE EUROPEAN USSR,
For primary bibliographic entry see Field 2D.
W79-06409

ESTIMATION OF THE ERROR IN THE DETERMINATION OF SOIL WATER STORAGE AT OBSERVATION POINTS,
For primary bibliographic entry see Field 2G.
W79-06410

ROLE OF HYDROPHYSICAL SOIL PROPERTIES IN SPRING FLOOD RUNOFF LOSSES,
For primary bibliographic entry see Field 2G.
W79-06411

RUNOFF-REGULATING PROPERTIES OF DRAINED FORESTS IN LATVIA,
Latvial Scientific Research Inst. of Forest Management Problems (USSR).
A. A. Ayre.
Soviet Hydrology: Selected Papers, Vol 16, No 2, p 173-175, 1977. 3 fig, 1 tab, 6 ref. Translated from Lesovedeniye, No 5, p 67-71, 1977.

Descriptors: *Runoff, *Drainage, *Forests, Soils, Soil types, Peat, Ditches, Rainfall, Precipitation(Atmospheric), Surface drainage, Trees, Forestry, *USSR, *Latvia.

The results of investigations of the runoff regime in the drained forests of Latvia were examined. The data obtained in small wooded drainage basins indicated that the relatively thin network of shallow ditches used at the present time to drain the forests does not cause adverse changes in river runoff. As compared to drained forests on hydromorphic mineral soils, the flood runoff from drained forests on peat soils is smoother, higher during the low-flow period, and more sustained. (Sims-ISWS)
W79-06414

FIELD PROCEDURES AND EVALUATION OF A SLUG DILUTION GAUGING METHOD IN MOUNTAIN STREAMS,
Geological Survey of Canada, Ottawa (Ontario).
For primary bibliographic entry see Field 5B.
W79-06415

INDUCED CHANNEL INSTABILITY AND HYDRAULIC GEOMETRY OF THE MANGAWHARA STREAM, NEW ZEALAND,
Waikato Univ., Hamilton (New Zealand). Dept. of Earth Sciences.
J. R. Bennett, and M. J. Selby.
Journal of Hydrology (New Zealand), Vol 16, No 2, p 134-147, 1977. 4 fig, 5 tab, 24 ref.

Descriptors: *Channel morphology, *Watersheds(Basins), *Streams, *Streamflow, Rivers, Channels, Hydraulic gradient, Erosion, Sedimentation, Forests, Pastures, Grasslands, Banks, Stability, Slope, Width, Meanders, Hydraulics, Hydrology, *Mangawhara Stream(New Zealand), *New Zealand, Forest clearing effects.

Approximately 50% of the Mangawhara catchment has been converted from forest to pasture in the last 50 years. Streamflow is now more responsive to intense rainfalls, and the supply of bedload to the channel has increased as a result of landsliding on the slopes. It has been suggested that increases in bedload and water discharge will be accompanied by increases in channel width, meander wavelength, and width-depth ratio and by a decrease in sinuosity. Changes in gradient and depth may be in either direction. For the Mangawhara, all recorded changes are as suggested, while both gradient and depth changes are small and of uncertain direction. Measures of the hydraulic geometry both at-a-station and downstream obey the laws established for rivers elsewhere. (Sims-ISWS)
W79-06416

WATER TEMPERATURES OF THE NGARURORO RIVER AT THREE STATIONS,
Ministry of Works, Napier (New Zealand). Water and Soil Div.
P. J. Grant.
Journal of Hydrology (New Zealand), Vol. 16, No. 2, p 148-157, 1977. 7 fig, 3 tab, 1 ref, 1 append.

Descriptors: *Water temperature, *Rivers, *Streamflow, Sampling, Measurement, On-site investigations, On-site data collections, Data processing, Correlation analysis, Regression anlysis, Temperature, Air temperature, Monthly, Foreign countries, Foreign research, Climatology, Hydrology, *New Zealand, *Ngaruroro River(New Zealand), *Kuripapango(New Zealand), *Whanawhana(New Zealand), *Fernhill(New Zealand).

Group 2E—Streamflow and Runoff

From 349 random measurements of water temperature during 1961-76 at Kuripapango, Whanawhana, and Fernhill on the Ngaruroro River, it was found that both mean monthly and mean maximum monthly water temperatures at each station followed an annual cycle with respective amplitudes of about 12 C and 15 C, and they correlated highly with mean monthly air temperature at Napier. The number of months during which stated water temperatures may be exceeded at each station increased in the downstream direction. A 5-month thermographic record of water temperature supplemented random measurements to define the high temperature limits at Fernhill in relation to flow rates. Highest water tempertures are likely to occur in the 10-20 cu m/s flow range, and the indication was that below 10 cu m/s, the water temperatures decrease rather than increase. This phenomenon is probably the effect of channel underflows and is reinforced during recession by base flow. A temperature duration pattern and models for the prediction of daily maximum and daily minimum water temperatures at Fernhill were given. (Sims-ISWS)
W79-06417

FLOW MEASUREMENT USING A CONDUCTIVITY FLOW METER--INITIAL INVESTIGATION,
Department of Scientific and Industrial Research, Taupo (New Zealand). Ecology Div.
For primary bibliographic entry see Field 7B.
W79-06419

STATISTICAL ANALYSIS OF SEDIMENT MOTIONS OF DUNES,
Stone and Webster Engineering Corp., Boston, MA.
For primary bibliographic entry see Field 2J.
W79-06421

VIRGIN RIVER STUDY--UTAH: MARCH, 1976,
Environmental Protection Agency, Denver, CO. Surveillance and Analysis Div.
For primary bibliographic entry see Field 5A.
W79-06423

2F. Groundwater

BASIC HYDROGEOLOGY - GLACIAL DEPOSITS AS AQUIFERS,
For primary bibliographic entry see Field 2J.
W79-06013

DATING GROUND WATER.
Ground Water Age, Vol. 12, No. 11, p 29-30, July, 1978.

Descriptors: *Radioactive dating, *Ground water, Radioisotopes, Australia, Groundwater movement, Groundwater recharge, Groundwater mining, Groundwater basins, Deep percolation, Artesian aquifers, Desertification, Water management(Applied).

Radioisotope dating of ground water in Australia's Great Artesian Basin indicates that ground water is moving southwest towards south Australia at the rate of about one meter per year. If water from artesian wells is thousands of years old it will not be replenished rapidly enough to compensate for its withdrawal and is, in effect, being mined. Thus, dating of ground water can be a tool in ground water management and can help avoid desertification in areas such as Australia. (Purdin-NWWA)
W79-06016

PROCEEDINGS OF THE FIRST WORKSHOP ON SAMPLING GEOTHERMAL EFFLUENTS.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 067, Price codes: A11 in paper copy, A01 in microfiche. Report EPA-600/9-76-011, May 1976. Proceedings of a Workshop held October 20-21, 1975, Las Vegas, Nevada. 244 p.

Descriptors: *Geothermal studies, *Monitoring, *Sampling, *Thermal water, Steam, Pollutants, Gases, Chemicals, Water chemistry, Water quality, On-site investigations, On-site data collections, Data processing, Effluents, Brines, Radioisotopes, Groundwater, Wells, Water wells, Springs, Equipment, Instrumentation, Analytical techniques, Methodology, *Geothermal energy.

This was a compilation of papers presented at the first in a series of workshops on environmental monitoring of geothermal energy development held on October 20 and 21, 1975, at the Environmental Protection Agency's Environmental Monitoring and Support Laboratory in Las Vegas, Nevada. The purpose of this workshop was to generate the exchange of ideas and knowledge needed to develop a set of standard geothermal sampling methods with assurance of quality in those methods. Representatives of industry, universities, and government presented 19 technical papers, 12 of which were published in this document. Their content and the discussions which followed the presentations provided guidance for developing a recognized Referenced Sampling Method Handbook. (See W79-06053 thru W79-06064) (Sims-ISWS)
W79-06052

GEOTHERMAL ENERGY DEVELOPMENT,
Stanford Univ., CA. Dept. of Civil Engineering.
P. Kruger.
In: Proceedings of the First Workshop On Sampling Geothermal Effluents; Workshop held October 20-21, 1975, Las Vegas, Nevada. Report EPA-600/9-76-011, p 1-35, May 1976. 7 tab, 12 ref.

Descriptors: *Thermal water, *Geothermal studies, *Energy, Projects, Research and development, Heat, Temperature, Heated water, Groundwater, Water quality, Reviews, Geothermal energy, Energy resources.

The Nation has embarked on an aggressive program to develop its indigenous resources of geothermal energy. For more than a decade, geothermal energy has been heralded as one of the more promising forms of energy alternate to oil and gas for electric power generation, but during the last 15 years, the total capacity in the U.S. has reached 502 MWe, about half the size of a single modern nuclear power plant. The upper 10 km of the earth's crust may contain more than 3 x 10 to the 26th power cal of heat, a resource base readily classified as vast. However, much of this energy is too diffuse to be exploitable as an energy source. Geothermal resources may be defined as localized deposits of geothermal heat concentrated at attainable depths, in adequate volumes, and at temperatures sufficient for commercial exploitation. The National Geothermal Program was described. (See also W79-06052) (Sims-ISWS)
W79-06053

GEOTHERMAL EFFLUENTS, THEIR TOXICITY AND PRIORITIZATION,
Woodward-Clyde Consultants, San Francisco, CA.
For primary bibliographic entry see Field 5B.
W79-06054

SOME PROBLEMS INVOLVED WITH SAMPLING GEOTHERMAL SOURCES,
Los Alamos Scientific Lab., NM.
For primary bibliographic entry see Field 5A.
W79-06055

DRILL STEM TESTING AND SAMPLING OF GEO-PRESSURED BRINES,
Halliburton Services, Duncan, OK.
For primary bibliographic entry see Field 5A.
W79-06056

THE SALINITY PROFILE OF THE EAST MESA FIELD AS DETERMINED FROM DUAL INDUCTION RESISTIVITY AND SP LOGS,
Bureau of Reclamation, Boulder City, NV. Region 3.
R. T. Littleton, and E. E. Burnett.
In: Proceedings of the First Workshop On Sampling Geothermal Effluents; Workshop held October 20-21, 1975, Las Vegas, Nevada. Report EPA-600/9-76-011, p 114-125, May 1976. 9 fig.

Descriptors: *Geothermal studies, *Thermal water, *Salinity, Wells, Water wells, Density, Brines, Salts, Electrical conductance, Water quality, Porosity, Groundwater, On-site investigations, Drill stem testing.

In a water-dominated geothermal reservoir such as the East Mesa Field, it is practical to obtain the general dimensions of dissolved mineral concentration by interpretation of dual induction resistivity logs and self-potential logs. Values so obtained may be substantially greater or less than those obtained by laboratory analyses of water samples from the same zones. Therefore, it is necessary to establish calibrating coefficients by borehole sampling and laboratory analyses. (See also W79-06052) (Sims-ISWS)
W79-06057

FIELD SAMPLING OF RADIOACTIVE GEOTHERMAL EFFLUENTS,
LFE Environmental Analysis Labs., Richmond, CA.
A. J. Soinski, D. E. Claridge, and R. Melgard.
In: Proceedings of the Firt Workshop On Sampling Geothermal Effluents; Workshop held October 20-21, 1975, Las Vegas, Nevada. Report EPA-600/9-76-011, p 126-142, May 1976. 3 fig, 3 tab, 17 ref, 1 append.

Descriptors: *Geothermal studies, *Thermal water, *Steam, *Sampling, *California, On-site investigations, On-site data collections, Radioisotopes, Radium radioisotopes, Powerplants, Water, Gases, Geysers, Hydrogen sulfide, Chemicals, Analytical techniques, Methodology, *The Geysers(CA), Fumaroles, Radon.

A sampling program for radioactive effluents from The Geysers geothermal power plant was described. Radon-222 was sampled both in the noncondensable fraction of geothermal steam and in the atmosphere. A variety of solid and liquid matrices, including steam condensate, cooling tower sludge, soil, and grass, were sampled and analyzed for 226Ra and 210Pb. The three radioactive isotopes 222Rn, 226Ra, and 210Pb are members of the naturally-occurring 238U radioactive decay chain. Stack sampling techniques were applied to the collection of steam, and a simple sampling train was constructed to separate and collect the condensable and non-condensable fractions. Collection techniques for selected solid and liquid matrices were described. Two complicating factors in the sampling and analysis program were addressed: the collection of atmospheric samples for radon from a local source in the presence of the natural background, and the long-term temporal variation in the emission rate of contaminants from a geothermal field. The sampling and analytical methods used were capable of detecting 222Rn, 226Ra, and 210Pb at environmental concentrations that are below the allowable maximums set in State of California regulations. (See also W79-06052) (Sims-ISWS)
W79-06058

ATMOSPHERIC DISCHARGE SAMPLING WHILE DRILLING GEOTHERMAL STEAM WELLS,
Frederiksen Engineering Co., Oakland, CA.
M. H. Hyman, and G. R. Fox.
In: Proceedings of the First Workshop On Sampling Geothermal Effluents; Workshop held October 20-21, 1975, Las Vegas, Nevada. Report EPA-600/9-76-011, p 175-180, May 1976. 2 fig.

Descriptors: *Geothermal studies, *Steam, *Sampling, Gases, Suspended solids, Separation techniques, Air pollution, Pollution abatement, Pollutants, Hydrogen sulfide, Mercury, Ammonia, Drilling, Wells, Noise, Scrubbers, Steam wells.

During the final phases of drilling live geothermal steam wells, considerable amounts of particulate (rock dust) and vapors are discharged. Abatement of particulates, gases, and noise was accomplished with water injection and utilization of centrifugal separators. A special method of sampling for particulates while drilling, even when active steam formations are encountered, was proved to be successful. The sampling train employed also was useful for source testing of hydrogen sulfide, mercury vapor, and ammonia. (See also W79-06052) (Sims-ISWS)
W79-06059

SAMPLING HOT SPRINGS FOR RADIOACTIVE AND TRACE ELEMENTS,
California Univ., Berkeley. Lawrence Berkeley Lab.
H. A. Wollenberg.
In: Proceedings of the First Workshop On Sampling Geothermal Effluents; Workshop held October 20-21, 1975, Las Vegas, Nevada. Report EPA-600/9-76-011, p 143-164, May 1976. 17 fig, 5 ref.

Descriptors: *Geothermal studies, *Thermal water, *Springs, *Sampling, Radioisotopes, Uranium, Trace elements, X-ray fluorescence, Chemicals, Analytical techniques, On-site investigations, On-site data collections, Groundwater, Radon.

The techniques described have proved successful in obtaining samples of hot and cold spring waters for x-ray fluorescence, neutron activation, and radiometric analyses. These sampling methods require only lightweight, portable field apparatus, and do not involve lengthy collection procedures. Good flexibility in field operations is necessary to accommodate the widely varying conditions of temperature, flow, and accessibility encountered at the different spring sites. (See also W79-06052) (Sims-ISWS)
W79-06060

UNION OIL COMPANY OF CALIFORNIA'S GEOTHERMAL SAMPLING TECHNIQUES,
Union Oil Co. of California, Brea.
D. J. Christofferson, R. N. Wheatley, and J. A. Baur.
In: Proceedings of the First Workshop On Sampling Geothermal Effluents; Workshop held October 20-21, 1975, Las Vegas, Nevada. Report EPA-600/9-76-011, p 165-173, May 1976. 8 fig.

Descriptors: *Geothermal studies, *Sampling, *Chemical analysis, *Steam, Chemicals, Gases, Analytical techniques, Methodology, Ammonia, Methane, Nitrogen, Hydrogen sulfide, Carbon dioxide, Equipment, Instrumentation.

The purpose was to describe the procedures used by Union Oil Company to sample and analyze produced geothermal steam for total composition. As is the case in any analytical problem, representative, accurate sampling is essential to the problem solution. Sampling-produced geothermal steam is no exception to this rule. The sample matrix that was dealt with was mainly water; and an analysis was done for gaseous and other compounds, some of which are highly soluble in water and some of which are relatively insoluble. The sampling and analysis for these compounds were described. (See also W79-06052) (Sims-ISWS)
W79-06061

SAMPLING A TWO-PHASE GEOTHERMAL BRINE FLOW FOR CHEMICAL ANALYSIS,
California Univ., Livermore. Lawrence Livermore Lab.
J. H. Hill, and C. J. Morris.
In: Proceedings of the First Workshop On Sampling Geothermal Effluents; Workshop held October 20-21, 1975, Las Vegas, Nevada. Report EPA-600/9-76-011, p 181-203, May 1976. 2 fig, 6 tab, 2 ref. ERDA W-7405-Eng-48.

Descriptors: *Geothermal studies, *Thermal water, *Steam, *Sampling, Brines, Chemicals, Chemical analysis, Hydrogen ion concentration, Oxidation-reduction potential, Dissolved solids, Suspended solids, Carbon dioxide, Sulfur, Cations, Anions, Salts, Calcium, Groundwater.

This report described an experiment designed primarily to define the problems associated with sampling the two-phase flow in a pipeline of geothermal brine. Analyses reported for 26 samples included chemical composition, oxidation potential, pH, density, and total solids. Changes in brine composition as the well operated during a 4-week period were evaluated. The apparatus and techniques used for sampling were described and evaluated. (See also W79-06052) (Sims-ISWS)
W79-06062

SAMPLING AND PRESERVATION TECHNIQUES FOR WATERS IN GEYSERS AND HOT SPRINGS,
Geological Survey, Menlo Park, CA.
J. W. Ball, E. A. Jenne, J. M. Burchard, and A. H. Truesdell.
In: Proceedings of the First Workshop on Sampling Geothermal Effluents; Workshop held October 20-21, 1975, Las Vegas, Nevada. Report EPA-600/9-76-011, p 218-234, May 1976. 7 fig, 10 ref.

Descriptors: *Geothermal studies, *Sampling, *Chemical analysis, Preservation, Geysers, Springs, Thermal waters, Gases, Chemicals, Hydrogen ion concentration, Oxidation-reduction potential, Temperature, Dissolved oxygen, Silica, Instrumentation, Equipment, Water chemistry, *Sample preservation.

Sampling of geothermal fluids presents unique challenges due to the instability and wide concentration range of many constituents. Unstable parameters, such as pH, Eh, temperature and dissolved oxygen, are determined on-site. Filtration of geothermal water is done with absolute minimum time-delay and exposure of the sample to air, by using a portable pump and non-contaminating, all-plastic or all-metal filter apparatus, for samples for inorganic or organic determinations, respectively. Sample preservatives and their safe, efficient transportation were discussed. Two techniques of geothermal gas collection were presented along with details of gas sampling apparatus. (See also W79-06052) (Sims-ISWS)
W79-06064

DETERMINATION OF THE MECHANISM OF RECHARGE IN THE LOS NARANJOS AREA IN MEXICO USING ENVIRONMENTAL ISOTOPE TECHNIQUES,
International Atomic Energy Agency, Vienna (Austria).
B. R. Payne, and I. S. Ortiz.
Water Resources Research, Vol. 15, No. 1, p 171-175, February 1979. 2 fig, 1 tab, 3 ref.

Descriptors: *Isotope studies, *Groundwater recharge, *Rivers, *Mexico, Recharge, Natural recharge, Discharge(Water), Evaporation, Precipitation(Atmospheric), Runoff, Infiltration, Groundwater, Oxygen isotopes, Deuterium, Sampling, Data processing, *Mexico, *Rio Blancio(Mexico).

The Rio Blanco crosses a coastal plain south of Veracruz in Mexico, and discharge measurements suggested that the river is recharging the groundwater system. The estimated evapotranspiration is very close to the mean annual precipitation, so estimates of effective recharge by infiltration of precipitation are imprecise. The variations in the stable isotopic composition (D and 18 O) of surface and groundwater samples were used to estimate the relative importance of the two sources of recharge to the groundwater system. The data indicated that recharge by infiltration of precipitation is the dominant source of recharge. This conclusion was based upon measurements from individual wells and also on the base flow of rivers originating in the plain, thus providing an estimate integrated over the area drained by the rivers. (Sims-ISWS)
W79-06067

EVOLUTION OF CONTAMINATED GROUNDWATER IN HOLT COUNTY, NEBRASKA,
Nebraska Univ., Lincoln. Conservation and Survey Div.
For primary bibliographic entry see Field 5B.
W79-06071

DISSOLVED IRON--AN INDICATOR OF THE GROUNDWATER COMPONENT OF SMALL STREAMS DRAINING A GRANITE TERRAIN, SOUTH CAROLINA,
South Carolina Univ., Columbia. Dept. of Geology.
For primary bibliographic entry see Field 2E.
W79-06078

THE GENERALIZATION OF DARCY'S LAW FOR NONUNIFORM FLOWS,
Tel Aviv Univ., (Israel). School of Engineering.
G. Dagan.
Water Resources Research, Vol 15, No 1, p 1-7, February 1979. 1 fig, 12 ref.

Descriptors: *Darcys Law, *Porous media, *Soil water movement, *Model studies, Mathematical models, Equations, Flow, Soil water, Groundwater, Groundwater movement, Nonuniform flow, Mathematics, Analytical techniques.

A generalized Darcy's law for nonuniform flows in which the pressure gradient depends on the velocity and its derivatives was adopted. The permeability coefficient, as well as a new coefficient, was investigated with the aid of the averaged dissipation equation. The additional coefficient appearing in the generalized law was estimated with the aid of a cell model, and the generalized law was employed in order to solve a few problems (Couette flow past a porous boundary, refraction at the boundary between two porous samples, and flow around a thin partition). Deviations from Darcy's law were found to be confined to thin layers near the medium boundaries. (Sims-ISWS)
W79-06080

GROUNDWATER RECHARGE AND PALEOCLIMATE IN THE SIRTE AND KUFRA BASINS, LIBYA,
Institute of Geological Sciences, Wallingford (England).
W. M. Edmunds, and E. P. Wright.
Journal of Hydrology, Vol 40, No 3/4, p 215-241, February 1979. 6 fig, 4 tab, 31 ref.

Descriptors: *Groundwater recharge, *Paleoclimatology, *Stable isotopes, *Radioisotopes, *Groundwater basins, *Radioactive dating, *Africa, Age, Aquifers, Groundwater, Rainfall, Monsoons, Evaporation, Deserts, Arid climates, Water quality, Sampling, Freshwater, Foreign countries, Foreign research, *Libya, *Sirte Basin(Libya), *Kufra Basin(Libya).

Stable and radio-isotope results (C, H, O) for groundwaters from the Sirte and northern Kufra basins were used to determine the recharge history during the Holocene and late Pleistocene. Radiocarbon ages were corrected on the basis of their stable carbon isotope ratios and on environmental samples from the areas. Two groups may be recognized, (1) low 14C activity groundwaters (13000-34000 yr BP) with delta 13C -5.6 to -11.7 parts per thousand; and (2) higher 14C activity groundwaters (5000-7800 yr BP) enriched in 13C up to delta 13C = -3.2 parts per thousand. A well-defined freshwater (less than 50 mg/l Cl(-)) channel can be traced within the aquifer for some 130 km through the region, which is considered to represent recharge from a former wadi. This water, with an age of + or - 7800 yr BP, is chemically and isotopically distinct from the regional groundwaters and provides direct evidence of a significant recharge event during the Holocene. The stable isotope (O and H) composition of groundwater from the Kufra and Sirte basins are all related by an evaporative line with slope delta D = 4.5 delta 180 - 35 with an intercept on the meteoric line of -11 parts per thousand. The spatial and temporal distribution of groundwaters in rela-

tion to the evaporative line suggests a progressive change in character of the recharge, which is controlled by a shift towards strongly convective rainfall during the Holocene. (Visocky-ISWS)
W79-06249

ESTIMATING SEEPAGE FROM A RESERVOIR FROM CHANGE IN HYDRAULIC HEAD,
Science and Education Administration, Chickasha, OK.
J. W. Naney, and T. B. Thompson.
Journal of Hydrology, Vol. 40, No. 3/4, p 201-213, February 1979. 8 fig, 1 tab, 12 ref.

Descriptors: *Seepage, *Reservoirs, *Oklahoma, On-site data collections, Groundwater movement, Floodwater, Groundwater, Water levels, Dams, Structures, Hydrologic budget, Hydrogeology, Evaporation, Observation wells, Flow nets, Geology, Hydraulic head.

An investigation of seepage below floodwater-retarding structures resulted in a method for estimating seepage from a reservoir based upon change in head. A typical structure was selected for the study, and physiographic and geologic features of the site were identified. Extensive hydrologic and hydrogeologic data were collected and analyzed for the site. A major inflow event was recorded in the reservoir in September 1965, and data from that event were used to develop an equation for estimating the amount of seepage lost from the structure in relation to the hydraulic head behind the structure. The method presented by the authors provides a physically based method for estimating the impact of a reservoir on the groundwater flow system assuming variable reservoir head conditions. (Visocky-ISWS)
W79-06250

BOUNDARY SOLUTIONS TO TWO PROBLEMS IN POROUS MEDIA,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
P. L-F. Liu, and J. A. Liggett.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY3, Proceedings Paper 14419, p 171-183, March 1979. 12 fig, 1 tab, 10 ref, 2 append. NSF ENG77-01479.

Descriptors: *Groundwater movement, *Porous media, *Groundwater recharge, *Model studies, Mathematical models, Numerical analysis, Groundwater, Recharge, Saturated flow, Boundary processes, Equations, Dams, Dikes, Soil surfaces, Soil water, Soil water movement.

The boundary integral equation method (BIEM) was used to solve free surface groundwater problems. The formulation included those problems in which the domain of the solution is infinite. Two methods were presented which treat infinite domains efficiently using the BIEM. These methods were illustrated by a two-dimensional recharge problem and by the flow through a dike on a pervious foundation. The BIEM solutions were compared to experimental data. Excellent agreement was observed. (Sims-ISWS)
W79-06254

A NOTE ON ESTIMATING FINITE DIFFERENCE INTERBLOCK HYDRAULIC CONDUCTIVITY VALUES FOR TRANSIENT UNSATURATED FLOW PROBLEMS,
Universite Scientifique et Medicale de Grenoble (France). Inst. de Mecanique.
R. Haverkamp, and M. Vanclin.
Water Resources Research, Vol 15, No 1, p 181-187, February 1979. 3 fig, 1 tab, 19 ref.

Descriptors: *Hydraulic conductivity, *Unsaturated flow, *Groundwater, *Model studies, Mathematical models, Groundwater movement, Flow, Infiltration, Soils, Soil water, Soil water movement, Moisture content, Hydrology, Finite difference methods.

Nine different methods of weighting interblock hydraulic conductivity values used for modeling one-dimensional water transfer in homogeneous, unsaturated soil were tested for their influence upon the accuracy of the finite difference solution. On the basis of these results, the most suitable weighting relation was selected. In a first stage, the numerical results obtained by the models using the various conductivity weighting formulas were compared with the quasi-analytical solution developed by Philip for a clay soil. In a second stage, the models were used to simulate a laboratory experiment carried out on a sandy soil. In both cases, rather drastic boundary conditions were applied. It appears clearly from these tests that the weighting errors are of critical influence on the accuracy of solution. As proposed in this note, the geometric mean taken over two adjacent hydraulic conductivity values is the only weighting method that generates little weighting error. The latter weighting relation was found to be preferable in terms of flexibility, precision, and feasibility. (Sims-ISWS)
W79-06255

UNSTEADY GROUNDWATER FLOW ON SLOPING BEDROCK,
Thessaloniki Univ., Salonika (Greece). Faculty of Technology.
C. N. Frangakis, and C. Tzimopoulos.
Water Resources Research, Vol 15, No 1, p 176-180, February 1979. 4 fig, 11 ref.

Descriptors: *Groundwater, *Unsteady flow, *Bedrock, *Model studies, Mathematical models, Groundwater movement, Discharge(Water), Flow, Slopes, Equations, Numerical analysis, Analytical techniques, Galerkin's method.

A numerical model based on the equation describing the unsteady groundwater flow on impervious sloping bedrock was formulated. The case which was studied concerned the groundwater flow from one canal to another with a sudden rising of the canal level as an upstream boundary condition, while the downstream level remained constant. Initially, at time t = 0, both levels were equal. The numerical model used the finite element technique with Galerkin's method. The stability and accuracy of the method were proven by comparison of numerical results with the Crank-Nicolson scheme. The algorithm developed for the finite element technique gave the same results as the one for the finite difference scheme. The effect of inclination of lower impervious boundary on outflow rate was studied. (Sims-ISWS)
W79-06256

MODELS OF GROUNDWATER FLOW IN STATISTICALLY HOMOGENEOUS POROUS FORMATIONS,
Tel Aviv Univ. (Israel). School of Engineering.
G. Dagan.
Water Resources Research, Vol 15, No 1, p 47-63, February 1979. 7 fig, 13 ref, 1 append.

Descriptors: *Groundwater, *Groundwater movement, *Porous media, *Model studies, Mathematical models, Flow, Permeability, Storage, Soils, Soil water, Soil water movement, Hydraulic conductivity, Statistics, Statistical models, Stochastic processes, Steady flow, Unsteady flow, Pressure head, Soil science.

Most natural porous formations display significant variations in space of permeability, K, and storativity, S. Such formations are regarded as random structures characterized by the permeability frequency distribution and its autocorrelation. With the aid of three basic length scales (L sub 1, microscale; L sub 2, integral scale of K autocorrelation; and L sub 3, length scale of space change of average K) a classification of aquifers was suggested. A similar classification was proposed for the flow regimes. The study was limited to statistically homogeneous or slowly varying formations (L sub 2 much less than L sub 3) and to uniform or slowly varying (in space and time) flows. In the section dealing with steady flows, effective permeability, as well as variances of head gradient, specific discharge, and head, was computed for one-, two-, and three-dimensional flows. Bounds and an estimate of the effective permeability in terms of a log normal permeability distribution were given. The computations were based on physical, simplified models of formation structure. It was shown that the head variance is grossly overestimated for one-dimensional flow through blocks 'in series', and the same is true for specific discharge for layers 'in parallel'. The two- and three-dimensional variances are much lower and are close to each other. The unsteady flow was analyzed with the aid of the relaxation time needed for blocks of different K, S to adapt to the environment. For flows which change slowly and uniformly, the effective permeability is that derived for steady uniform flows, and the effective storativity is equal to the S arithmetic mean. The head gradient variance computed with the aid of some physical models was compared with that of steady uniform flow, and it was shown that for sufficiently slow time changes, the flow field can be considered momentarily uniform. (Sims-ISWS)
W79-06262

WETLANDS PROTECTION: THE REGULATORY ROLE OF THE UNITED STATES ARMY CORPS OF ENGINEERS,
For primary bibliographic entry see Field 6E.
W79-06295

SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES--LOWER MISSISSIPPI REGION,
Geological Survey, Little Rock, AR. Water Resources Div. and Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W79-06308

GROUND-WATER CONDITIONS IN THE NAVAJO SANDSTONE IN THE CENTRAL VIRGIN RIVER BASIN, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 6D.
W79-06310

INTERPRETATION OF WELL LOGS IN A CARBONATE AQUIFER,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 7B.
W79-06312

HYDROLOGIC DATA, 1974-77, STOVEPIPE WELLS HOTEL AREA, DEATH VALLEY NATIONAL MONUMENT, INYO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 2A.
W79-06313

FIELD VERIFICATION OF A ONE-DIMENSIONAL MATHEMATICAL MODEL FOR TRANSIENT COMPACTION AND EXPANSION OF A CONFINED AQUIFER SYSTEM,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 6A.
W79-06316

GROUND-WATER RESOURCES OF THE UPPER WINOOSKI RIVER BASIN, VERMONT,
Geological Survey, Boston, MA. Water Resources Div.; and Vermont Agency of Environmental Conservation. Dept. of Water Resources.
A. L. Hodges, Jr., R. E. Willey, J. W. Ashley, and D. Butterfield.
Geological Survey Water-Resources Investigations 77-120 (open-file report), 1977. 27 p, 3 fig, 4 plates, 7 tab, 17 ref.

Descriptors: *Groundwater resouces, *Aquifer characteristics, *Water quality, *Vermont, Water wells, Well data, Drillers logs, Pumping, Water yield, Hydrogeology, Groundwater recharge, Water levels, Hydrologic data, Groundwater availability, Hydraulic conductivity, Transmissivity, Chemical analysis, Maps, *Upper Winooski River basin(Vt).

Ground water in the upper Winooski River basin, Vermont, occurs in bedrock and in overlying unconsolidated deposits of glacial origin. Bedrock in the area is composed of a series of metamorphic and igneous rocks. Median yield for 126 wells in four different bedrock formations ranges from 5 to 6 gallons per minute, and median depth ranges from 130 to 200 feet. Lineaments, interpreted as fracture of breakage zones in bedrock, were mapped to identify zones where well yields are expected to be higher than average. Unconsoliidated deposits in the upper Winooski River basin include unsorted till, water-sorted clay, silt, sand, and gravel. Properly constructed wells in saturated deposits of sand or gravel having high permeability can yield large quantities of water. Twenty-six domestic wells in these unconsolidated deposits have a median yield of 18 gallons per minute and a median depth of 58 feet. Chemical analysis of water from six wells indicate a median hardness of 120 milligrams per liter, (as CaCO3), which is moderately hard. Iron and manganese are common constituents of ground water in the area, and several analyses show concentrations of these elements which exceed recommended National Academy of Sciences and National Academy of Engineering (1973) limits for public drinking water supplies. (Woodard-USGS)
W79-06317

FINITE-ELEMENT ANALYSIS OF THE TRANSPORT OF WATER AND SOLUTES IN TILE-DRAINED SOILS,
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
J. F. Pickens, R. W. Gillham, and D. R. Cameron.
Journal of Hydrology, Vol. 40, No. 3/4, p 243-264, February 1979. 12 fig, 1 tab, 25 ref.

Descriptors: *Finite element analysis, *Groundwater movement, *Ion transport, Numerical analysis, Mathematical models, Solutes, Porous media, Saturated flow, Unsaturated flow, Tiles, Drains, Soils, Theoretical analysis, Water pollution, Leaching, Model studies, Galerkin technique, Solute transport.

The finite-element method based on a Galerkin technique was used to formulate the problem of simulating the two-dimensional (cross-sectional) transient movement of water and solute in saturated or partially saturated nonuniform porous media. The numerical model utilizes linear triangular elements. Nonreactive as well as reactive solutes whose behavior can be described by a distribution coefficient or first-order reaction term were considered. The flow portion of the model was tested by comparison of the model results with experimental and finite-difference results for transient flow in an unsaturated sand column, and the solute transport portion of the model was tested by comparison with analytical solution results. The model was applied to a hypothetical case involving movement of water and solutes in tile-drained soils. The simulation results showed the development of distinct solute leaching patterns in the soil as drainage proceeded. Although applied to a tile drainage problem in this study, the model should be equally useful in the study of a wide range of two-dimensional water and solute migration problems. (Visocky-ISWS)
W79-06393

SEMINUMERICAL SIMULATION OF SINGLY DISPERSIVE CONVECTION IN GROUNDWATER,
Technion - Israel Inst. of Tech., Haifa. Dept. of Civil Engineering.
H. Rubin.
Journal of Hydrology, Vol 40, No 3/4, p 265-281, February 1979. 5 fig, 22 ref, 1 append.

Descriptors: *Numerical analysis, *Convection, *Dispersion, *Groundwater, *Thermal water, Geothermal studies, Currents(Water), Water circulation, Mathematical models, Equations, Aquifers, Groundwater movement, Temperature, Model studies, *Israel.

Geothermal activity may lead to convection currents in groundwater. Such currents considerably affect transport phenomena in the aquifer. In this study, the applicability of a seminumerical approach for the simulation of flow conditions in such an aquifer was presented. Flow field variables are expanded through truncated sets of eigenfunctions, which leads to a system of general first-order differential equations that can be solved by applying available subroutines. Criteria of flow field stability, parameters affecting flow conditions, and quantitative analysis of transport processes in the aquifer were studied. (Visocky-ISWS)
W79-06394

RATES OF LEACHING OF RADIUM FROM CONTAMINATED SOILS: AN EXPERIMENTAL INVESTIGATION OF RADIUM BEARING SOILS FROM PORT HOPE, ONTARIO,
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
For primary bibliographic entry see Field 5B.
W79-06400

LEACHING OF PHOSPHATE FROM AGRICULTURAL SOILS TO GROUNDWATER,
Connecticut Agricultural Experiment Station, New Haven. Dept. of Soil and Water.
For primary bibliographic entry see Field 5B.
W79-06401

THE PHYSICS OF LONG TERM DRAWDOWNS IN PUMPING FROM ARTESIAN AQUIFERS,
TERRAQUA ApS, Kalundborg (Denmark).
H. Kaergaard.
Nordic Hydrology, Vol 9, No 5, p 249-262, 1978. 8 fig, 13 ref.

Descriptors: *Drawdown, *Pumping, *Aquifers, *Model studies, Mathematical models, Artesian aquifers, Aquitards, Storage, Leakage, Groundwater, Groundwater movement, Wells, Water wells, Water levels, Water table, Aquifer characteristics, Hydrogeology, *Denmark, *Egebjerg(Denmark).

The applicability of the Theis-formula and the Jacob-Hantush leakage-formula as tools for the description of water-level variations due to pumping from artesian aquifers was shown to be rather limited, especially in long-term pumping situations. The limitations were discussed and illustrated through a review of some mathematical models with more reliable and physical realistic preconditions, and a general perception of the physics governing the drawdowns in pumping from leaky artesian aquifers was established. Data from 10 years of heavy pumping from a leaky artesian multi-aquifer at Egebjerg near Horsens, Denmark, were analyzed, and the result turned out to be in good agreement with the theoretical discussion. (Sims-ISWS)
W79-06404

2G. Water In Soils

LONGITUDINAL DISPERSION WITH NONLINEAR ADSORPTION IN POROUS MEDIA,
Maryland Univ., College Park. Water Resources Research Center.
For primary bibliographic entry see Field 5B.
W79-06027

A WATER MANAGEMENT MODEL FOR SHALLOW WATER TABLE SOILS,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
R. W. Skaggs.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 641, Price codes: A10 in paper copy, A01 in microfiche. Water Resources Research Institute, University of North Carolina, Raleigh. Report No 134, November, 1978. 178 p, 57 fig, 29 tab. OWRT A-086-NC(4). 14-34-0001-7070.

Descriptors: *Water management, *Surface drainage, Subsurface drainage, Subsurface irrigation, *Computer models, Soil moisture, Water table, *Soil water movement.

A study was conducted to develop and test a water management model, DRAINMOD, for shallow water table soils. The objective was to develop a model for soils that normally require artificial drainage, either surface or subsurface, for efficient crop production. The model has the capability of simulating on a day-to-day, hour-by-hour basis the table position, soil water content, drainage ET and surface runoff in terms of climatological data, soil properties, crop parameters, and the water management system design. By simulating the performance of alternative system designs over several years of record, an optimum water management system can be designed. The basis of the model is a soil water balance in the soil profile. It is composed of a number of separate components, incorporated as subroutines to evaluate various mechanisms of water movement and storage in the soil profile. These components include methods to evaluate infiltration, subsurface drainage, surface drainage, potential evapotranspiration (ET), actual ET, subirrigation and soil-water distribution. Approximate methods were used for each component so that the required inputs would be simplified and consistent with available data. The model was constructed so that improved methods can easily be substituted for existing components as they become available. (Kiger-North Carolina)
W79-06050

EVAPOTRANSPIRATION FROM DOUGLAS FIR STANDS EXPOSED TO SOIL WATER DEFICITS,
British Columbia Univ., Vancouver. Dept. of Soil Science.
For primary bibliographic entry see Field 2D.
W79-06068

THE GENERALIZATION OF DARCY'S LAW FOR NONUNIFORM FLOWS,
Tel Aviv Univ., (Israel). School of Engineering.
For primary bibliographic entry see Field 2F.
W79-06080

DIRECT IN-FIELD MEASUREMENT OF NITROUS OXIDE FLUX FROM SOILS,
California Univ., Riverside. Dept. of Soil and Environmental Science.
J. C. Ryden, L. J. Lund, and D. D. Focht.
Soil Science Society of America Journal, Vol 42, No 5, p 731-737, September-October, 1978. 2 fig, 5 tab, 29 ref.

Descriptors: *Denitrification, *Nitrates, Gas chromatography, Measurement, Fertilization, Ozone, Methodology, Data collections.

A method was developed whereby nitrous oxide N2O effusing from a soil surface could be contained and selectively trapped for subsequent analysis. The methodology proposed provides a direct measurement of N2O flux which is integrated over the sampling period used. The methodology is sufficiently simple that it embodies a monitoring capability which can be used to measure N2O evolution in on-going agricultural practice. The method may also provide a basis for the direct measurement of total N loss as a result of denitrification, if the further reduction of N2O can be inhibited. (Skogerboe-Colorado State)
W79-06147

A RAPID METHOD FOR ESTIMATING THE NITROGEN-SUPPLYING CAPABILITY OF A SOIL,

Pennsylvania State Univ., University Park. Dept. of Agronomy.
R. H. Fox, and W. P. Piekielek.
Soil Science Society of America Journal, Vol 42, No 5, p 751-753, September-October, 1978. 2 fig, 1 tab, 8 ref.

Descriptors: *Nitrogen, Nutrient requirements, Fertilization, Nutrients, Crop response, Corn, Correlation analysis, *Soil tests.

Nitrogen fertilizer recommendations in humid regions have been primarily based on crop N requirements without regard for the variability in the N-supplying capability of the soil. The authors found that two previously proposed N availability indexes, 0.01M NaHCO3 and boiling 0.01M CaCl2 extractable N, were well correlated (r=0.77 and 0.86, respectively; $P < 0.01$ for both) with the capability of eight Pennsylvania soils to supply N to field grown corn, (Zea mays L.). However, the time and expense required for these analyses may preclude routine use by soil testing laboratories. In seeking ways to shorten and simplify the analyses, it was found that the ultraviolet (UV) absorption by the 0.01M NaHCO3 soil extract at 260 nm was as well correlated with the N-supplying capability of the test soils ($r = 0.865$ $P < 0.01$) as the best of the previously evaluated extractable N indexes. This new method is as rapid, simple, and inexpensive as the methods currently used to measure availability of other essential nutrients in the soil. It was also demonstrated how this method can be used to predict more accurately the fertilizer N needs for corn. (See also W79-06160) (Skogerboe-Colorado State)
W79-06159

FIELD TESTING OF SEVERAL NITROGEN AVAILABILITY INDEXES,
Pennsylvania State Univ., University Park. Dept. of Agronomy.
R. H. Fox, and W. P. Piekielek.
Soil Science Society of America Journal, Vol 42, No 5, p 747-750, September-October, 1978. 2 fig, 3 tab, 9 ref.

Descriptors: *Nitrogen, Fertilization, *Soil tests, Crop production, Chemical analysis, Crop response, Corn.

Eight N availability indexes were correlated with the capability of eight Pennsylvania soils to supply N to field-grown corn (Zea mays L.) in 1976 and 1977. Boiling 0.01M CaCl2 and 0.01M NaHCO3-extractable N were both significantly correlated at the 1% level ($r = 0.86$ and 0.77, respectively) with the N-supplying capability of the soils from the combined 1976 and 1977 experiments. Autoclave-extractable NH4-N and total soil N were significantly correlated with the soil supplying capability at the 5% confidence level ($r = 0.70$ and 0.68, respectively). Walkley-Black soil organic matter, soil NO3(-), and H2SO4-extractable and KCl-extractable N were not significantly correlated with N availability in the field. Though four of the indexes were well correlated with the N availability in the soil, time and expense necessary for these analyses may preclude routine use by soil testing laboratories. (Skogerboe-Colorado State)
W79-06160

SOIL WATER IN SOUTHWESTERN MINNESOTA: FOUR STAGES,
Minnesota Univ., St. Paul. Dept. of Soil Science.
D. G. Baker, and W. W. Nelson.
Journal of Soil and Water Conservation, Vol. 34, No. 1, p 28-30, January-February 1979. 2 fig, 2 tab, 8 ref.

Descriptors: *Soil water, *Recharge, *Consumptive use, *Minnesota, On-site investigations, On-site data collections, Data processing, Frozen soils, Crops, Corn, Soybeans, Evapotranspiration, Evaporation, Seasonal, Temperature, Precipitation(Atmospheric), Discharge(Water), Climatology.

A unique series of soil water records from a southwestern Minnesota watershed show how and with what efficiency precipitation is used. These records, now covering 17 years (1960-1976), include years of climatic extremes that range from periods of surplus precipitation to the drought of 1976. The watershed is in the western Corn Belt where soils seldom recharge completely with water. While unusual in most of the Corn Belt, this recharge condition is common over half the United States. In addition to the soil water records, associated data were available that permit investigation of the area's climatology and hydrology. (Sims-ISWS)
W79-06236

BOUNDARY SOLUTIONS TO TWO PROBLEMS IN POROUS MEDIA,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2F.
W79-06254

ESTIMATION OF THE PORE SIZE DISTRIBUTION FROM THE MOISTURE CHARACTERISTIC,
Ghent Rijksuniversiteit (Belgium). Dept. of Applied Mathematics.
E. H. D'Hollander.
Water Resources Research, Vol 15, No 1, p 107-112, February 1979. 3 fig, 1 tab, 6 ref.

Descriptors: *Pores, *Soil moisture, *Moisture content, *Statistical models, Probability, Mathematical models, Distribution patterns, Curves, Air-water interfaces, Equations, Capillary action, Saturation, Retention, Theoretical analysis, Pore radius, Suction.

Most pF curves are shaped as cumulative distribution functions. From this observation, restricted to nonshrinking or swelling soils, a close relationship was established between the moisture characteristic and the pore size referred to as the effective pore radius. For many soils showing a moisture characteristic similar to a normal cumulative distribution function, the derived pore size distribution is log normal. In this case, a direct identification technique was developed which yields the parameters of the density function from the experimental pF theta relationship. Practical applications demonstrated the validity of this probabilistic model, which gives good agreement with morphometric pore size data available in the literature. The model also gives rise to an analytical expression for the pF curve in terms of two structural parameters of the porous system, the mean and the standard deviation of the effective pore radius. (Visocky-ISWS)
W79-06258

MODELS OF GROUNDWATER FLOW IN STATISTICALLY HOMOGENEOUS POROUS FORMATIONS,
Tel Aviv Univ. (Israel). School of Engineering.
For primary bibliographic entry see Field 2F.
W79-06262

RATES OF LEACHING OF RADIUM FROM CONTAMINATED SOILS: AN EXPERIMENTAL INVESTIGATION OF RADIUM BEARING SOILS FROM PORT HOPE, ONTARIO,
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
For primary bibliographic entry see Field 5B.
W79-06400

LEACHING OF PHOSPHATE FROM AGRICULTURAL SOILS TO GROUNDWATER,
Connecticut Agricultural Experiment Station, New Haven. Dept. of Soil and Water.
For primary bibliographic entry see Field 5B.
W79-06401

ESTIMATION OF THE ERROR IN THE DETERMINATION OF SOIL WATER STORAGE AT OBSERVATION POINTS,
N. Ye. Leonova.
Soviet Hydrology: Selected Papers, Vol. 16, No. 2, p 98-101, 1977. 3 fig, 3 tab, 3 ref. Translated from Trudy Gosudarstvennogo Gidrologicheskogo Instituta, No. 233, p 118-126, 1977.

Descriptors: *Soil water, *Water storage, *Flood forecasting, Floods, Runoff, Snowmelt, Melt water, Soils, Soil types, Crops, Agriculture, Rivers, Drainage, Storage, *USSR, Error estimation.

In forecasting and computing springtime flood runoff, the question arises as to the accuracy of determination of the major flood-forming factors, which are the water equivalent of snow and the wetting and freezing of the soil. The computed estimates of errors in the determination of the average water storage in soil using long-period observations of soil moisture in the Don River basin upstream of Kazanskaya village and of observations over 5 years by the expedition of the State Hydrological Institute in small drainage areas of this basin lead to the following conclusions: (1) Errors in the initial data on the water storage in soil, determined in the areas of agrometeorological stations under homogeneous crops, are close to the permissible limit (delta = 0.5) or exceed it, amounting to 8-18% (0- to 30-cm layer), 7-12% (0- to 50-cm layer), and 6-9% of the average (0- to 100-cm layer). (2) Errors in the initial data on water storage, averaged over several areas of agrometeorological stations, on average water storage determined on 3-km courses in small drainage areas of 2000-5000 sq km, and on water storage measured at individual points on these courses are within permissible limits. (3) Annual average water storage in soil under winter crops is determined least accurately in June in the upper soil horizons. This is associated with an increase in the variations in soil moisture as a result of uneven soil drying. (Sims-ISWS)
W79-06410

ROLE OF HYDROPHYSICAL SOIL PROPERTIES IN SPRING FLOOD RUNOFF LOSSES,
I. L. Kalyuzhnny, K. K. Pavlova, and N. V. Sokolova.
Soviet Hydrology: Selected Papers, Vol. 16, No. 2, p 102-107, 1977. 3 fig, 2 tab, 10 ref. Translated from Trudy Gosudarstvennogo Gidrologicheskogo Instituta, No. 233, p 127-136, 1977.

Descriptors: *Soil properties, *Soil water, *Water storage, *Floods, Flood forecasting, Soils, Soil types, Infiltration, Permeability, Porosity, Storage, Forest soils, Agriculture, Frozen soils, Runoff, Drainage, Melt water, Snowmelt, *USSR.

The volume and dynamics of meltwater losses by infiltration are determined by the infiltration capacity of soils in a drainage basin. Under certain soil temperature to soil moisture ratios, the infiltrating water can clog all the water-conducting pores and the soil becomes impermeable, forming a so-called barrier layer. The problem of the conditions under which the ice forming during the crystallization of infiltrating water is capable of clogging all the water-conducting pores has been solved thermo-physically and made practically usable. Forest soils are highly permeable and a barrier layer forms extremely rarely in them. Field soils are less permeable and a barrier layer forms fairly frequently in their upper layers during warm spells in winter and during the snow melting period in spring. The losses and coefficient of spring flood runoff in wooded basins are determined mainly by the soil moisture deficit in the pre-spring period and are virtually independent of soil freezing depth. The main factors determining the magnitude and dynamics of meltwater losses by infiltration in the field are the depth of freezing and degree of wetting of the soil and also its thermal properties. The water storage in the upper meter of soils in the field and forest during the pre-spring period are similar, but the soil moisture deficit is greater in the forest. Soil water storage varies in the course of the winter, and its greatest increase is observed in winters with warm spells. (Sims-ISWS)
W79-06411

2H. Lakes

TIME AND LENGTH SCALES FOR THE ONE-DIMENSIONAL ASSUMPTION AND ITS RELATION TO ECOLOGICAL MODELS,
Army Engineer Waterways Experiment Station, Vicksburg. Environmental Effects Lab.
D. E. Ford, and K. W. Thornton.
Water Resources Research, Vol. 15, No. 1, p 113-120, February 1979. 4 fig, 68 ref.

Descriptors: *Model studies, *Temporal distributions, *Spatial distributions, Ecology, Lakes, Reservoirs, Oceans, Waves(Water), Temperature, Water temperature, Biology, Chemistry, Hydrodynamics, Mathematical models, Statistical models.

The vertical one-dimensional assumption was examined with respect to its validity for mathematical ecological models of lakes or reservoirs. Analysis of the time and length scales characterizing the hydrodynamics, chemistry, and biology showed that the 2 scales are inexorably coupled, and their interaction dictated both upper and lower bounds for the lake size that can be characterized by a one-dimensional model. For an update frequency or forcing time scale of 1 day, the one-dimensional model was restricted to lakes characterized by length scales of 0.5-10 km. This range is preliminary and dependent on model formulation and update frequency. Inconsistencies between the model formulation scales for the hydrodynamics, chemistry, and biology may result in erroneous model predictions. (Sims-ISWS)
W79-06073

SALINITY TRANSPORT BETWEEN LAYERS OF A STRATIFIED SHEAR FLOW,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.
J. Freitas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 652, Price codes: A04 in paper copy, A01 in microfiche. MS thesis, February 1979, 68 p, 7 tab, 2 append., 6 fig. OWRT B-139-UTAH(3), 14-34-0001-7191.

Descriptors: *Saline lakes, Saline water systems, *Stratified flow, Hydrodynamics, Parametric hydrology, Entrainment, Great Salt Lake, Pycnocline, Richardson number.

In order to effectively manage the Great Salt Lake and its tributaries, an advanced knowledge of the hydrodynamic processes occurring within this body of water must be available. A research project was undertaken to determine parameter relationships and the extent of entrainment occurring at the pycnocline within the southern arm of the Great Salt Lake. Dealing with the two-layer stratified system existing within the southern arm--an upper dilute brine layer over a lower dense brine layer--an attempt was made to model interfacial conditions of the southern arm within a laboratory flume. Using characteristic hydrodynamic, kinematic, and geometric parameters of the lake the southern arm of the lake was artificially created in the flume. Through the use of this experimental apparatus a determination was made of the relationships between dimensionless numbers representing upward mixing, relative density difference and the Richardson number. In addition, predictions of the magnitude of the entrainment rate per unit area, k, were established. Visual observations of the interface condition at various velocity steps were also made. Comparison of these results to those made by other entrainment researchers, allowed substantiation of this research. When compared to other salt lake research the flume model consistently predicted larger values of entrainment. It is felt that this research more accurately represented the conditions at the interface of the southern arm, while other researchers made necessary assumptions to expedite the theoretical development of the processes at the interface.
W79-06106

MODELING AND VERIFICATION: THE TWO INDISPENSABLE LEGS FOR PROGRESS TOWARD UNDERSTANDING AND MANAGEMENT OF AQUATIC SYSTEMS AS DEMONSTRATED BY A STUDY OF COASTAL CURRENTS IN LARGE LAKES,
Wisconsin Univ.-Milwaukee. Center for Great Lakes Studies.
C. H. Mortimer.
In: American-Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Karkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 316-338 (Discussion p 339), September 1978. 17 fig, 13 ref. EPA-600/9-78-024.

Descriptors: *Lakes, *Lake Michigan, *Model studies, *Coastal waters, *Currents(Water), *Thermocline dynamics, Computer models, Optimal development plans, Aquatic systems, Remote sensing, Wind velocity, Temperature, Lake Ontario, Basins, Channels, Waves(Water), Risks, Stratification, Physics, Prediction, Kelvin waves, Water intake, Milwaukee(Wis), Meter stations, Offshore depth, Wind direction, Systems analysis, Simulation analysis.

There are two risks associated with computerized mathematical modeling of aquatic systems: (1) limited research funds will not be spent in an optimum interactive balance between model development and field experimentation; and (2) when eventually it becomes apparent that the desired predictive capability has not lived up to expectation, adverse reaction will starve the development of better models. Addressed herein is the avoidance of the first risk, which if successfully accomplished, will diminish the second risk. Our best hope of progress lies in a proper balance between questions directed both to models and to lakes, often in an iterative two-legged sequence in which models assist the planning of optimized schemes of data acquisition. Soundly-conceived and adequately-based 'hard' sets of data, from experiments and lake surveys, are the only means through which models can be used to their full potential. Models are discussed as scientific tools to define the most revealing questions we can ask about lakes. Considered are the physics of large lakes, namely the responses of the stratified basin to wind impulses. Studied are models of thermocline dynamics; with these models, signals from large-basin coastal currents can be heard. The article concludes with some general remarks on lake ecosystem modeling. (See also W79-06166) (Bell Graf-Cornell)
W79-06179

CONSTRUCTION OF A MODEL OF LAKE BAIKAL ON PRINCIPLES OF SELF-ORGANIZATION,
Akademiya Nauk URSR, Kiev. Inst. Kibernetiki.
A. G. Ibakhnenko.
In: American-Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Karkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 340-369 (Discussion p 370-371), September 1978. 10 fig, 4 tab, 40 ref. EPA-600/9-78-024.

Descriptors: Self-organization, *Model construction, *Lake Baikal(USSR), *Model studies, Algorithms, Equations, Water pollution, Dissolved solids, Suspended solids, Forecasting, Biomass yield, Phytoplankton, Zooplankton, Mixing zones, Systems analysis.

Lake Baikal contains 80% of the freshwater reserve in the USSR and 20% of the world source. Irkutsk University and the Institute of Cybernetics of Ukr. SSR Academy of Sciences have carried out joint research aimed at a better understanding of correlation links between phytoplankton and zooplankton in Lake Baikal. The results of this research are given in Appendix I. The main part of this report reflects the results of a joint investigation carried out by the Novocherkassk Hydrochemical Institute and the Institute of Cybernatics of Ukr. SSR Academy of Science (1973-1975). It is concerned with the construction of three mathematical models of Lake Baikal mixing zones on the basis of self-organization principles. (See also W79-06166) (Bell Graf-COrnell)
W79-06180

THE BOTTOMLESS DAM,
Monash Univ., Clayton (Australia).
For primary bibliographic entry see Field 8A.
W79-06263

OLD WOMAN CREEK, OHIO: THE DESIGNATION OF A FRESHWATER ESTUARINE SANCTUARY,
Ohio Dept. of Natural Resources, Columbus.
For primary bibliographic entry see Field 6E.
W79-06301

CONCEPTUAL FRAMEWORK FOR COORDINATED GREAT LAKES MONITORING,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
S. V. Rastonis, J. W. Male, and H. E. Allen.
Journal of Great Lakes Research, Vol 4, No 2, p 117-126, June 1978. 2 tab, 30 ref.

Descriptors: *Great Lakes, *Monitoring, *Mathematical models, Sampling, Surveys, Remote sensing, Planning, Pollutants, Water pollution, Sediments, Biology, Fish, Aquatic plants, Chemicals, Methodology, Lakes, Limnology, Model studies.

The utility of conceptual models was discussed as a basis for effective development of coordinated monitoring efforts on the Great Lakes. The use of conceptual models was illustrated in two ways, (1) the development of a methodology for specifying monitoring objectives of the Great Lakes, based on a conceptual model, and (2) the presentation of a comprehensive method for defining resource needs to achieve monitoring objectives. (Sims-ISWS)
W79-06402

LAKE ERIE IN MID-WINTER,
Canada Centre for Inland Waters, Burlington (Ontario).
N. M. Burns, F. Rosa, and A. Gedeon.
Journal of the Great Lakes Research, Vol 4, No 2, p 134-141, June 1978. 5 fig, 4 tab, 10 ref.

Descriptors: *Lake Erie, *Great Lakes, *Sampling, *Winter, Surveys, Lakes, Temperature, Water temperature, Nutrients, Oxygen, Dissolved oxygen, Phytoplankton, Biomass, Diatoms, Nitrogen compounds, Silica, Phosphorus, Ice, Ice cover, Lake ice, On-site investigations, Limnology.

The results of 4 surveys of Lake Erie during mid-winter were presented. The most recent survey, from February 15 to 17, 1977, was conducted during an exceptionally cold winter to determine whether 6 weeks of complete ice-cover had led to low levels of oxygen concentration in the lake. The results showed that all parts of the lake, even the shallow, normally highly productive areas, contained acceptable levels of oxygen. Apparently, production of oxygen by a small phytoplankton population counter-balanced a fairly low uptake of oxygen and maintained the level of oxygen concentration in most of the water above 90% saturation. The 1976-1977 winter phytoplankton biomass was low (0.1 to 1.0 gm biomass per cu m) and consisted mostly of diatoms. It appears that some of the phytoplankton were photosynthetically active under 70 cm of ice and 23 m of water. All surveys of the lake showed the water to be virtually isothermal at a temperature just above the freezing point of water. The maximum temperature differences observed were about 0.2 deg in magnitude and were found in the East Basin. Nevertheless, the slight temperature differences apparently caused density currents under the ice, which resulted in lowered oxygen concentrations in the deepest part of the East Basin. (Sims-ISWS)
W79-06403

2I. Water In Plants

IF YOU KNOW THE WEATHER YOU CAN PREDICT THE YIELD,
Clemson Univ., SC. Dept. of Horticulture.
J. R. Haun.
Crops and Soils Magazine, Vol. 31, No. 2, p 7-9, November, 1978. 3 fig.

Descriptors: Crop production, Crop response, Climatic data, Weather data, Plant growth.

This paper presents a new concept in the evaluation of plant-environment relations for developing yield prediction systems. This approach involves the daily measurement of plant response in the field under natural, uncontrolled variations in weather conditions. These plant growth data, with associated weather variables, are to be analyzed by computer to develop the yield prediction system. (Skogerboe-Colorado State)
W79-06035

SALT AND WATER STRESS INFLUENCES NITROGEN METABOLISM IN RED KIDNEY BEANS,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
J. N. E. Frota, and T. C. Tucker.
Soil Science Society of American Journal, Vol. 42, No. 5, p 743-746, September-October, 1978. 6 tab, 27 ref.

Descriptors: *Salinity, *Moisture deficit, Nitrogen, Metabolism, Beans, Crop production.

Both salinity and water deficit reduce yields of crop plants. This study was an attempt to provide a better understanding of these stress effects on N metabolism and the utilization of NH4-N and NO3-N. Red kidney bean plants (Phaseolus vulgaris L.) were grown under salt stress (NaCl), water stress (carbowax), and in a normal nutrient solution (control). The 15N in NO3(-), NH4(+), alpha amino acids, total soluble-N and protein-N in plant shoots were analyzed after the plants received 15(NH4)2SO4 and K15NO3 in nutrient solution for 6, 12, 24, and 48 hours. Sodium chloride and carbowax resulted in equal accumulations of NO3-N, NH4(+), and free alpha amino acids in bean shoots. Protein synthesis was significantly reduced in bean shoots when the plants were subjected to NaCl salinity and carbowax, with either source of N, and the inhibition was more severe under salt stress than water stress. (Skogerboe-Colorado State)
W79-06156

ABSORPTION RATES OF AMMONIUM AND NITRATE BY RED KIDNEY BEANS UNDER SALT AND WATER STRESS,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
J. N. E. Frota, and T. C. Tucker.
Soil Science Society of America Journal, Vol. 42, No. 5, p 753-756, September-October, 1978. 2 fig, 5 tab, 21 ref.

Descriptors: *Salinity, *Moisture stress, Absorption, Ammonium salts, Nitrates, Beans, Moisture deficit, Crop production, *Crop response, Nitrogen.

The purpose was to gain additional knowledge regarding the influence of salinity and water deficit on plant uptake of NH4(+) and NO3(-). The absorption patterns of NH4(+) and NO3(-) by red kidney beans (Phaseolus vulgaris L.) were determined under normal conditions (water stress) using an inverse isotope dilution technique with 15N. Salt and water stress inhibited the absorption of both NH4(+) and NO3(-). There was no difference between these two stress treatments in NH4(+) uptake, but carbowax restricted NO3(-) uptake more than did NaCl. Under NaCl salinity the plants absorbed the same amount of N independent of N source; under water stress more NH4(+) than NO3(-) was absorbed. Water absorption was reduced by both stress treatments; N and water uptake were highly correlated. Root permeability decreased in plants subjected to stress. Dry matter production and total N per plant decreased, but the N percentage increased in the stressed plants. (Skogerboe-Colorado State)
W79-06157

2J. Erosion and Sedimentation

BASIC HYDROGEOLOGY - GLACIAL DEPOSITS AS AQUIFERS,
B. Whitehead.
Canadian Water Well, Vol. 5, No. 1, p 34-35, February, 1979. 1 fig.

Descriptors: *Glacial aquifers, *Well yield, Glacial drift, Deposition(Sediments), Hydrogeology, Till, Outwash, Lake sediments.

The classification of glacial deposits is explained in terms of their mode and environment of deposition. Four basic types of glacial deposits are described: till, outwash, lacustrine and marine, and ice-contacted. A typical glacial stratigraphic sequence and the resulting variety of aquifer types are shown in a generalized cross section. The well yields in the various aquifers increases with the thickness, degree of sorting, and grain size of the deposit and the degree of interconnection of the aquifer to recharge sources. (Purdin-NWWA)
W79-06013

FACTORS AFFECTING PHOSPHATE ABSORPTION EQUILIBRIA IN LAKE SEDIMENTS,
Dufresne-Henry Engineering Corp., North Springfield, VT.
For primary bibliographic entry see Field 5C.
W79-06032

DERIVATION OF THE PROBABILITY DENSITY FUNCTION OF CERTAIN BIASED SAMPLES OF COARSE RIVERBED MATERIAL,
Pennsylvania State Univ., University Park. Dept. of Geosciences.
K. W. Potter.
Water Resources Research, Vol. 15, No. 1, p 21-22, February 1979. 1 tab, 5 ref.

Descriptors: *Beds, *Bed load, *Sampling, *Data processing, Analytical techniques, Mathematics, Particle size, Streambeds, Statistics, Probability, Equations, Sediments, Rivers, Riverbed material, Weighting functions.

Several commonly used procedures for sampling coarse riverbed material result in samples that are biased toward the larger particles. Kellerhals and Bray recommend correcting the bias by scaling the sample frequency of each frequency interval by the inverse of the appropriate power of the mean grain size of the interval. If, however, grain size is assumed to be log-normally distributed, it is possible to determine the distribution of the biased sample. This provides explicit bias factors for the sample moments. (Sims-ISWS)
W79-06077

OIL SPILL VULNERABILITY OF THE BEAUFORT SEA COAST,
South Carolina Univ., Columbia. Dept. of Geology.
For primary bibliographic entry see Field 5C.
W79-06210

YUKON DELTA COASTAL PROCESSES STUDY,
Houston Univ., TX. Dept. of Geology.
For primary bibliographic entry see Field 5C.
W79-06219

SEDIMENT TRANSPORT IN NORTON SOUND - NORTHERN BERING SEA, ALASKA,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 5C.
W79-06227

COASTAL PROCESSES AND MORPHOLOGY OF THE BERING SEA COAST OF ALASKA,
Geological Survey, Menlo Park, CA.
A. J. Sallenger, Jr., J. R. Dingler, and R. Hunter.
In: Environments: Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XII, Hazards, p 451-502, October 1978. 7 fig, 4 tab, 11 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Geomorphology, *Erosion, *Hazards, *Water pollution, *Structural engineering, Baseline studies, Resources development, Pipelines, Environmental effects, Alaska, *Outer Continental Shelf, *Coastal processes, Bering Sea, Petroleum development.

Storms pose major hazards to coastal developments along the Bering Sea coast of Alaska. During FY76, debris lines that resulted from the November, 1974 storm were found to be nearly 5 m above mean sea level in places along the northern Bering Sea of Alaska. Coastal change is not, however, restricted to storm conditions. Giant cusps were observed to migrate along the coast at 5-6 m/day during the period 6/23/51 - 7/30/51. This migration caused as much as 50 m accretion at a given location over a period of several weeks. One use of this kind of data is to establish a coastal development set-back line. That is, the appropriate government body would prohibit developments within areas subject to inundation by storm surge or undermining by coastal erosion. For structures that must cross the coastline (e.g. pipelines) the maximum scour depth must be established for both storms and over the long-term. The south coast of the Alaska Peninsula has numerous deep embayments which may one day be considered for deep water port facilities. These ports could service offshore petroleum exploitation in both the Bristol Bay area and areas offshore the Pacific coast of the Alaska Peninsula. In order to provide some baseline information, a reconnaissance of the physical coastal environment of Cold Bay and Pavlov Bay was undertaken. The results can be used for preliminary siting studies, qualitative assessment of coastal stability and the long-term directions of transport of particulate pollutants in the littoral system. (Sinha-OEIS)
W79-06228

SHORELINE HISTORY OF CHUKCHI AND BEAUFORT SEAS AS AN AID TO PREDICTING OFFSHORE PERMAFROST CONDITIONS,
Geological Survey, Menlo Park, CA.
D. M. Hopkins, and R. W. Hartz.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XII, Hazards, p 503-573, October 1978. 12 ref, 5 append, map infold. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Hazards, *Geomorphology, *Gravels, *Quarries, *Erosion, Permafrost, Water pollution, Coasts, Baseline studies, Resources development, Environmental effects, Alaska, *Outer Continental Shelf, Petroleum development, Chukchi Sea, Beaufort Sea, Coastal processes.

This report presents detailed data on stratigraphy, lithology, pollen rain, longshore sediment transport, coastal erosion, coastal morphology, and shoreline history. Exploration and production of offshore oil and gas reserves in the Beaufort Sea will require large amount of artificial fill for the construction of causeways, pipelines, artificial islands, and support facilities. Gravel is the primary material used for artificial fill in the arctic, and the location of potential quarry sites is essential to the development and production phases. The environmental impact of quarrying operations can be minimized by locating areas of thick gravel deposits or sites where gravel is now accumulating. Construction of onshore support facilities also requires

knowledge of potential flooding hazards during storm surges and the possible effects of coastal erosion. (Sinha-OEIS)
W79-06229

THE HYDRODYNAMICS AND SEDIMENTOLOGY OF A HIGH (TIDAL AND WAVE) ENERGY EMBAYMENT (SWANSEA BAY, NORTHERN BRISTOL CHANNEL),
University Coll. of Swansea (Wales). Dept. of Geology and Oceanography.
M. Collins, G. Ferentinos, and F. T. Banner.
Estuarine and Coastal Marine Science, Vol. 8, No. 1, p 49-74, January 1979. 14 fig, 1 tab, 47 ref.

Descriptors: *Sediments, *Currents(Water), *Bays, Tidal effects, Tides, Waves(Water), Circulation, Water circulation, On-site data collections, Current meters, Bathymetry, Sampling, Waves(Water), Sedimentation, Hydrodynamics, *Wales, *Swansea Bay(Wales).

Swansea Bay may be taken as an example of an embayment which has a complex and variable hydrodynamic regime resulting from the interaction of its bathymetry and configuration with an adjacent rectilinear, semi-diurnal tidal system and with super-imposed oceanic swell and more locally generated seas. Eulerian tidal current observations in Swansea Bay indicated a coastal tidal current pattern which has developed from the main currents along the northern Bristol Channel. The observed pattern consists of an anticlockwise eddy in the western part of the embayment and a zone of divergence on the eastern side, between the eddy and the main offshore flow. Wave data, as represented by refraction diagrams and the distribution of sea bed orbital velocities, have demonstrated that high energy wave conditions prevail over the area. Sediment distribution and transport in Swansea Bay are controlled by tidally and wave-induced current patterns, but also are related to bathymetry and the exposure of relict deposits. However, evidence was presented to suggest that local dredging activities influence the sedimention processes. (Sims-ISWS)
W79-06237

THE DISTRIBUTION OF ORGANIC MATERIAL AND TRACE METALS IN SEDIMENTS FROM THE RIVER LIFFEY ESTUARY, DUBLIN,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
For primary bibliographic entry see Field 2L.
W79-06239

ORGANIC MATTER IN SURFICIAL SEDIMENTS OF THE MIRAMICHI ESTUARY, NEW BRUNSWICK, CANADA,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Environmental Marine Geology.
For primary bibliographic entry see Field 2L.
W79-06240

ROSS SEA REGION IN THE MIDDLE MIOCENE: A GLIMPSE INTO THE PAST,
Macquaries Univ., North Ryde (Australia). School of Biological Sciences.
H. Brady, and H. Martin.
Science, Vol 203, No 4379, p 437-438, February 2, 1979. 1 fig, 1 tab, 5 ref. NSF DP76-20657, DP76-17231.

Descriptors: *Sediments, *Cores, *Diatoms, *Pollen, *Antarctic, Palynology, Spores, Ice, Cold regions, Vegetation, Biology, Ferns, Geology, Marine geology, *Ross Ice Shelf, Miocene sediments.

Fossil diatoms and pollen from sea-floor sediments beneath the Ross Ice Shelf indicated that a permanent ice cover was not present in the Ross Sea and that vegetation including angiosperms, gymnosperms, and ferns existed on at least some parts of the largely glaciated Antarctic mainland in the late middle Miocene. (Sims-ISWS)
W79-06244

MIOCENE GLACIOMARINE SEDIMENTS FROM BENEATH THE SOUTHERN ROSS ICE SHELF, ANTARCTICA,
Northern Illinois Univ., De Kalb. Dept. of Geology.
P. N. Webb, T. E. Ronan, Jr., J. H. Lipps, and T. E. DeLaca.
Science, Vol. 203, No.4379, p 435-437, February 2, 1979. 2 fig, 13 ref. NSF DP76-20657, DP76-17231.

Descriptors: *Sediments, *Cores, *Microorganisms, *Antarctic, Ice, Drill holes, Drilling, Clays, Sands, Gravels, Sedimentary structures, Marine geology, Geology, Diatoms, Plankton, Sedimentation, Cold regions, *Ross Ice Shelf, Glaciomarine sediments, Miocene sediments.

Glaciomarine sediments with middle Miocene microfaunal assemblages are exposed at the sea floor below the southern Ross Ice Shelf. Plio-Pleistocene sediments are not present. Post-Miocene glacial sediments may have been deposited but removed by relatively recent ice shelf grounding. A meager Recent microfauna is present in some core tops. (Sims-ISWS)
W79-06246

MODELING ALLUVIAL CHANNEL BED TRANSIENTS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
V. M. Ponce, J. L. Garcia, and D. B. Simons.
Journal of the Hydraulic Division, American Society of Civil Engineers, Vol. 105, No. HY3, Proceedings Paper 14456, p 245-256, March 1979. 6 fig, 10 ref, 2 append.

Descriptors: *Bed load, *Model studies, *Alluvial channels, Beds, Erosion, Aggradation, Fluvial sediments, Numerical analysis, Rivers, Sedimentation, Mathematical models, Sand waves, *Bed load movement, Fluvial hydraulics.

A mathematical model was developed to simulate bed transient formation and propagation in alluvial channels. The mode is of the known-discharge type, i.e., within one time step, the water discharge is considered steady. This technique allows for the implicit numerical modeling of bed transient propagation using longer time steps than would otherwise be possible using the conventional sequential routing method. Instability due to ill-posing of the sediment transport function is circumvented by using a power relation between bed material transport and mean flow velocity. Errors in mass conservation due to linearization at the boundary are eliminated by using a nonlinear formulation of the upstream boundary condition. (Lee-ISWS)
W79-06252

PARTICLE SIZE OF SEDIMENTS COLLECTED FROM THE BED OF THE AMAZON RIVER AND ITS TRIBUTARIES IN MAY AND JUNE 1977,
Geological Survey, Denver, CO. Water Resources Div.
C. F. Nordin, Jr., R. H. Meade, W. F. Curtis, N. J. Bosio, and B. M. Delaney.
Geological Survey open-file report 79-329, 1979. 23 p, 1 fig, 3 tab, 3 ref.

Descriptors: *Bottom sediments, *Rivers, *South America, *Sampling, *Particle size, Analytical techniques, Fluvial sediments, *Bed material, *Amazon River.

One-hundred-eight samples of bed material were collected from the Amazon River and its major tributaries between Belem, Brazil, and Iquitos, Peru. Samples were taken with a standard BM-54 sampler or with pipe dredges from May 18 to June 5, 1977. Most of the samples have median diameters in the size range of fine to medium sand and contain small percentages of fine gravel. Complete size distributions are tabulated. (Woodard-USGS)
W79-06309

TRENDS IN SEDIMENTATION,
Geological Survey, Reston, VA. Water Resources Div.; and Geological Survey, Towson, MD. Water Resources Div.
H. R. Feltz, and W. J. Herb.
In: The Freshwater Potomac: Proceedings of a Symposium in January 1977, College Park, Maryland. Published by the Interstate Commission on the Potomac River Basin, Rockville, Maryland, p 167-171, 1978. 3 fig, 13 ref.

Descriptors: *Sedimentation, *Potomac River, *Sediment transport, *Water quality, *Sediment yield, Bottom sediments, Sampling, Chemical analysis, Trace elements, Heavy metals, Nitrogen, Phosphorus, Pesticides, Polychlorinated biphenyls, Streamflow, Runoff, Storms, Hurricanes, Land use, Sediment control, *District of Columbia, *Maryland, *Potomac River basin, *Anacostia River.

The Potomac River, draining an area of 29,700 square kilometers above tidal influence, is known to have wide fluctuations in water and sediment discharge in rapid response to rainfall. Most of the suspended-sediment load is transported during storms, and loads vary from storm to storm and seasonally. Hurricanes such as Agnes in 1972 can also produce high runoff and sediment discharge. Cropland, construction sites, and stream channels undergoing realinement are major sources of suspended sediment. Available figures indicate that changes in land use over the whole basin were insignificant during 1961-76. About 95 percent of the basin consists of rural, forested, and open-water areas. On the basis of annual values of sediment discharge per unit volume of water discharge, the overall trend in the basin was a decrease in suspended-sediment discharges during the mid- to late 1960's followed by an increase in the early 1970's. The high suspended-sediment discharges associated with Hurricane Agnes in 1972 are partly responsible for this increase. In the mid-1970's the trend reversed, and decreases have reached the levels of the early and mid-1960's. A dramatic decrease in suspended-sediment discharge for the Anacostia River near Colesville, Md., is attributed primarily to an increased use of sediment controls on urban construction sites. Chemical analysis of bottom sediment samples collected throughout the basin show the distribution of heavy metals, nitrogen, phosphorus, and residues of pesticides and polychlorinated biphenyls. Trace quantities to relatively high concentrations were found at several sites. (Woodard-USGS)
W79-06319

UNIT STREAM POWER EQUATIONS FOR TOTAL LOAD,
Corps of Engineers, Chicago, IL. North Central Div.
C. T. Yang.
Journal of Hydrology, Vol. 40, No. 1/2, p 123-138, January 1979. 4 fig, 4 tab, 20 ref.

Descriptors: *Sediment load, *Bed load, *Methodology, *Data collections, *Dunes, *Streamflow, Regression analysis, Dimensional analysis, Sediment transport, Natural streams, *Unit stream power, *Sediment concentration, Incipient motion, Potential energy expenditure.

A dimensionless unit stream power equation for the computation and prediction of total sediment concentration was obtained without using any criterion for incipient motion. This equation was compared with a similar dimensionless unit stream power equation with the inclusion of criteria for incipient motion. Comparisons between the measured results from laboratory flumes and natural rivers and the computed results from these two unit stream power equations indicated that they are equally accurate in predicting the total sediment concentration in the sand size range. For the 1259 sets of data compared, the average computed result from these equations was only 3% higher than the measured result. (Singh-ISWS)
W79-06392

UNIT STEP AND FREQUENCY RESPONSE FUNCTIONS APPLIED TO THE WATERSHED FLUVIAL SYSTEM,

Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (Israel). Dept. of Agricultural Engineering.
T. C. Sharma, and W. T. Dickinson.
Journal of Hydrology, Vol 40, No 3/4, p 323-335, February 1979. 3 fig, 3 tab, 8 ref.

Descriptors: *Sediments, *Sediment yield, *Model studies, Mathematical models, Equations, Watersheds(Basins), Runoff, Erosion, Sediment transport, Streams, Rivers, Sedimentation, Sedimentology.

Unit step response and frequency response functions were shown to provide useful information to model and understand the watershed runoff-sediment yield process. One of the applications of the unit step response was to rank watersheds for their sediment production potentials. The frequency response function was used to indicate the memory content of the watershed runoff-sediment yield system. (Sims-ISWS)
W79-06395

IMPACT OF MAN'S ACTIVITIES ON THE CHEMICAL COMPOSITION OF THE SEDIMENTS OF LAKES SUPERIOR AND HURON,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5B.
W79-06399

DISTRIBUTION OF SUSPENDED SEDIMENTS IN THE SHALLOWS OF RESERVOIRS AND POSSIBILITY OF ESTIMATING THEM BY THE INTEGRATION METHOD,
V. M. Klaven.
Soviet Hydrology: Selected Papers, Vol. 16, No. 2, p 113-119, 1977. 4 fig, 3 tab, 10 ref. Translated from Trudy Gosudarstvennogo Gidrologicheskogo Instituta, No. 242, p 115-128, 1977.

Descriptors: *Sediments, *Suspended solids, *Reservoirs, *Shallow water, Sampling, Data processing, Waves(Water), Currents(Water), Sediment transport, Analytical techniques, Distribution patterns, Suspended particle concentrations.

The distribution of suspended-particle concentration in the shallows of bodies of water must be taken into account to solve engineering problems (planning water intakes, ships' channels, harbors, thermal electric power stations) and to improve methods for measuring and computing suspended-particle concentration. The following conclusions can be drawn from the analysis of measurements of suspended sediment transport in the shallows of the Kayrak-Kum, Kakhovka, and Kremenchug reservoirs, made in a broad range of variation of wave heights, velocities of longshore currents, rock composition of the shallows, and suspended-particle concentrations in the water: (1) The time-averaged suspended-particle concentrations on verticals in the surf zone increase approximately exponentially from the water surface to the bottom, and the nature of their distribution does not vary noticeably with a change in the rock composition of the shallows from fine- to medium-grained sand with admixtures of various amounts of silt particles. (2) The distribution of the suspended-particle concentration in the water (rho) and of elementary suspended-sediment transport (r) over the width of the surf zone is most frequently of two types: a distribution with a single maximum in the water-edge zone with rho and r values decreasing gradually toward the edge of the shallows; and a distribution with two maxima, one in the water-edge zone and the other in the zone of the outer-line of breakers, usually confined to the central part or the edge of the shallows. (Sims-ISWS)
W79-06412

INDUCED CHANNEL INSTABILITY AND HYDRAULIC GEOMETRY OF THE MANGAWHARA STREAM, NEW ZEALAND,
Waikato Univ., Hamilton (New Zealand). Dept. of Earth Sciences.
For primary bibliographic entry see Field 2E.
W79-06416

SEDIMENT YIELDS FROM SMALL FORESTED CATCHMENTS NORTH WESTLAND-NELSON, NEW ZEALAND,
Forest Research Inst., Christchurch (New Zealand). Protection Forestry Div.
C. L. O'Loughlin, L. K. Rowe, and A. J. Pearce.
Journal of Hydrology (New Zealand), Vol 17, No 1, p 1-15, 1978. 8 fig, 5 tab, 21 ref.

Descriptors: *Sediment yield, *Sediment transport, *Forest watersheds, *Sediments, Gravels, Sands, Forests, Drainage, Storms, Runoff, Storm runoff, Discharge(Water), Flow, Hydrographs, Sedimentation, Erosion, Sedimentology, *New Zealand.

Sediment yield rates from 6 small forest catchments in North Westland and from 4 small forest catchments in Nelson averaged 55 cu m/sq km p.a. and 5 cu m/sq km p.a., respectively. A total of 55% of sediment yield was produced from the North Westland catchments over 821 days during one large storm event with a return period of approximately 20 years. In the Nelson catchments, 90% of the sediment yield over 608 days occurred during a single storm event with a return period of 6 months to one year. It was hypothesized that the development of the forested gravel hill country landscapes in North Westland and Nelson have depended closely on infrequent high intensity storms which occur perhaps once every 10 years or less frequently. (Sims-ISWS)
W79-06418

STATISTICAL ANALYSIS OF SEDIMENT MOTIONS OF DUNES,
Stone and Webster Engineering Corp., Boston, MA.
C. S. Hung, and H. W. Shen.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 105, No HY3, Proceedings Paper 14438, p 213-227, March 1979. 18 fig, 5 tab, 13 ref, 1 append.

Descriptors: *Bed load, *Colorado, *Channels, *Dunes, Rivers, Sedimentation, Cesium, Sedimentation rates, Statistical methods, Hydraulics, Sediment transport, Alluvial channels, *Statistical analysis, Alluvial bed forms, Cesium 137.

Statistical analyses were done on the movements of bed load particles over alluvial bed forms from data collected in a large laboratory flume at Colorado State University. The bed load particles were tagged by radioactive tracer--Cesium 137. Statistical properties of the random variables and the correlations between these variables were investigated. It was found that within the test range, the mean and variance of longitudinal step length, the mean wavelength and the mean wave height of bed forms, the particle speed, the variance of vertical step length, and the variance of lateral step length all increase with the increase of flow. However, the coefficients of variation for both wave height and wavelength remain approximately the same for all flow conditions tested. The ratio of average wave length to average wave height decreases with the increase of flow. (Lee-ISWS)
W79-06421

SEA-FLOOR INSTABILITY OF CONTINENTAL SHELF OFFSHORE CENTRAL AND NORTHERN CALIFORNIA,
BBN-Geomarine Services Co., Oxnard, CA.
A. Mahmood, and R. Son.
In: 'Recommendations for Baseline Research in Central and Northern California Relative to Offshore Resource Development', Proceedings of Conference/Workshop held in San Francisco, CA, October 22-24, 1976, p 99-105, January 1977. 4 fig, 1 ref.

Descriptors: *Stability, *Continental shelf, *Geology, Water quality, Sedimentation, Resources development, Hazards, *Outer Continental Shelf, Sea floor, Northern California, Central California.

The continental shelf along central and northern California coast is very narrow as compared to other coastal areas of United States. The narrow shelf width may force offshore exploration in some steep areas. The potential for sea-floor instability needs to be evaluated as it would influence offshore resource development facilities. From available data a sketchy assessment of slope instability potential can be made. A figure shows areas of moderate and steep slopes along the central and northern California coast. The areas are within the 600 feet water depth. In addition to slope steepness and nature of sediments, data on evidence of past or present instability can be gathered by identifying slumps, scarps, and other landslide topography features on high-resolution data. (See also W79-06464) (Sinha-OEIS)
W79-06465

FISHERIES AND WILDLIFE,
California State Dept. of Fish and Game, Menlo Park.
For primary bibliographic entry see Field 5C.
W79-06467

2K. Chemical Processes

PROCEEDINGS OF THE FIRST WORKSHOP ON SAMPLING GEOTHERMAL EFFLUENTS.
For primary bibliographic entry see Field 2F.
W79-06052

GEOTHERMAL EFFLUENTS, THEIR TOXICITY AND PRIORITIZATION,
Woodward-Clyde Consultants, San Francisco, CA.
For primary bibliographic entry see Field 5B.
W79-06054

SAMPLING A TWO-PHASE GEOTHERMAL BRINE FLOW FOR CHEMICAL ANALYSIS,
California Univ., Livermore. Lawrence Livermore Lab.
For primary bibliographic entry see Field 2F.
W79-06062

SAMPLING AND PRESERVATION TECHNIQUES FOR WATERS IN GEYSERS AND HOT SPRINGS,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 2F.
W79-06064

PHOSPHORUS INTERACTIONS IN THE AQUATIC ENVIRONMENT: A SURVEY OF THE LITERATURE,
Vermont Univ., Burlington. Water Resources Research Center.
For primary bibliographic entry see Field 5B.
W79-06109

EFFICIENT AMENDMENT USE IN SODIC SOIL RECLAMATION,
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Inst. of Soil and Water.
For primary bibliographic entry see Field 5G.
W79-06150

CATION-EXCHANGE CAPACITY OF CLAY-RICH SOILS IN RELATION TO ORGANIC MATTER, MINERAL COMPOSITION, AND SURFACE AREA,
Department of Agriculture, Sainte-Foy (Quebec).
Y. A. Martel, C. R. De Kimpe, and M. R. Laverdiere.
Soil Science Society of America Journal, Vol. 42, No. 5, p 764-767, September-October, 1978. 1 fig, 7 tab, 16 ref.

Descriptors: *Cation exchange, Clay minerals, *Organic matter, Mineralogy, Soil horizons, *Regression analysis, Soil texture.

Regression analyses were used to correlate organic matter, texture and surface area values to the cation-exchange capactiy (CEC) of clay-rich soils in the lowlands of Quebec. The Ap, Bg and Cg

horizons of 11 Gleysolic soils (Aqu-Suborders) were analyzed for CEC, exchangeable bases and acidity, total and fine clay contents, organic matter, surface area and mineralogical composition. The soils contained illite, chlorite, smectite, and vermiculite in addition to quartz and feldspars. In the Ap horizon, total clay and fine clay contents were better related to CEC than organic matter and surface area. In the Bg and Cg horizons, surface area gave the best correlation with CEC. As calculated by multiple regression equations, CEC values of organic matter increased with depth from 56.5 to 223 meq/100 g, while CEC values of total clay decreased from 37.7 to 22.5 meq/100 g and that of fine clay decreased from 57.5 to 50.7 meq/100 g. Variations in the mineralogical composition, although small, were sufficient to explain nearly 50% of the variations in the CEC. (Skogerboe-Colorado State)
W79-06154

ADSORPTION AND EXTRACTABILITY OF MOLYBDENUM IN RELATION TO SOME CHEMICAL PROPERTIES SOIL,
Pahlavi Univ., Shiraz (Iran). Dept. of Soil Science.
N. Karimian, and F. R. Cox.
Soil Science Society of America Journal, Vol. 42, No. 5, p 757-761, September-October, 1978. 3 fig, 4 tab, 32 ref.

Descriptors: *Molybdenum, *Adsorption, *Soil chemistry, Soil tests, Iron oxides, Organic matter, Hydrogen ion concentration, Phosphorus.

Adsorption of Mo from aqueous solutions was determined for eight soils from the Atlantic Coastal Plain and Piedmont regions. The data followed the Feundlich isotherm more consistently than the Langmuir. Adsorption increased as the organic matter and/or Fe oxide contents of the soils increased. Adsorption from an aqueous solution that was initially 0.3 mM Mo (AdMo) also was determined on 32 soils collected from the regions. The AdMo level was positively correlated with Fe oxide and organic matter contents and negatively correlated with pH and P levels. The level of Mo extracted with acid ammonium oxalate (Grigg Mo) and an anion exchange resin (resin Mo) were also determined and related to soil chemical properties and a lime treatment. Grigg Mo was positively correlated with amorphous and free fe oxide by oxalate. Resin Mo was positively correlated with pH but not with other soil properties. Incubating soils with CaCO3 increased the level of rsin Mo. (Skogerboe-Colorado State)
W79-06155

GROUNDWATER RECHARGE AND PALEOCLIMATE IN THE SIRTE AND KUFRA BASINS, LIBYA,
Institute of Geological Sciences, Wallingford (England).
For primary bibliographic entry see Field 2F.
W79-06249

VARIATIONS IN THE ACID CONTENT OF RAIN WATER IN THE COURSE OF A SINGLE PRECIPITATION,
Arizona Univ., Tucson. Dept. of Chemistry.
M. D. Seymour, S. A. Schubert, J. W. Clayton, Jr., and Q. Fernando.
Water, Air, and Soil Pollution, Vol 10, No 2, p 147-161, August 1978. 5 fig, 2 tab, 18 ref.

Descriptors: *Rain water, *Acids, *Rainfall, Sampling, Chemical analysis, Analytical techniques, Chemicals, Acidic water, Hydrogen ion concentration, Volumetric analysis, Precipitation(Analysis), Data processing, Pollutants, Water pollution, Water pollution sources, Pollutant identification, Chemistry of precipitation.

The major acid components in the rainwater collected during 5 different rainfall events in July and August 1977 were found to be a strong acid, the weak acid NH4(+), and dissolved CO2 from the atmosphere. Variations in their concentrations were determined as a function of time in the course of each of the rainfall events. Two experimental methods were used in this investigation, a microtitrimetric method and a coulometric method. The data were analyzed by the use of modified Gran functions. Both methods gave the same results. The most significant observation was that the strong acid concentration increased from very low values to a maximum and then decreased in the course of a single rainfall event. (Sims-ISWS)
W79-06398

CLIMATE,
California State Univ., Long Beach.
For primary bibliographic entry see Field 2B.
W79-06451

OCEANIC AND ATMOSPHERIC VELOCITY FIELDS AND WATER CHEMISTRY,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
D. Halpern.
In: 'Recommendations for Baseline Research in Central and Northern California Relative to Offshore Resource Development', Proceedings of Conference/Workshop held in San Francisco, CA, October 22-24, 1976, p 91-97, Jan 1977. 3 fig, 7 ref.

Descriptors: *Baseline studies, *Oceanography, *Meteorology, *Water composition, Chemistry, Resources development, Environmental effects, Path of pollutants, *Outer Continental Shelf, Northern California, Central California, Velocity fields.

Knowledge of the physical environment is an integral part of environmental baseline studies. The trajectory of oil introduced at the surface is determined to a large extent by the space and time variations of the wind and current fields. Accurate interpretation of biological and chemical measurements is dependent upon knowledge of the physical environment. The purpose of this presentation is to describe the richness of the space and time scales of the oceanic and atmospheric velocity fields and water chemistry to be expected in the outer continental region of central and northern California. Because of the scarcity of state-of-the-art physical oceanographic observations within this region, examples are illustrated with data obtained elsewhere. (See also W79-06464) (Sinha-OEIS)
W79-06466

2L. Estuaries

THE HYDRODYNAMICS AND SEDIMENTOLOGY OF A HIGH (TIDAL AND WAVE) ENERGY EMBAYMENT (SWANSEA BAY, NORTHERN BRISTOL CHANNEL),
University Coll. of Swansea (Wales). Dept. of Geology and Oceanography.
For primary bibliographic entry see Field 2J.
W79-06237

THE DISTRIBUTION OF ORGANIC MATERIAL AND TRACE METALS IN SEDIMENTS FROM THE RIVER LIFFEY ESTUARY, DUBLIN,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
G. B. Jones, and M. B. Jordan.
Estuarine and Coastal Marine Science, Vol 8, No 1, p 37-47, January 1979. 4 fig, 1 tab, 30 ref.

Descriptors: *Estuaries, *Sediments, *Metals, *Organic matter, Sampling, Data processing, Chemical analysis, Carbon, Nitrogen, Humic acids, Fibers(Plants), Lignins, On-site data collections, Hydrography, Water circulation, Rivers, Sedimentation, *Ireland, *River Liffey Estuary(Ireland).

Sediments of the River Liffey Estuary have been analyzed for organic carbon, Kjeldahl nitrogen, humic acid, and crude fibre contents. Several trace metals also were analyzed. The hydrographic conditions which control the transport of this material also were studied over a tidal cycle. Results indicated that the upper reaches of the estuary are isolated from the incoming seawater and that trace metal enrichment is localized. This metal enrichment is accompanied by an increase in the organic carbon, nitrogen, and humic acid levels. (Sims-ISWS)
W79-06239

ORGANIC MATTER IN SURFICIAL SEDIMENTS OF THE MIRAMICHI ESTUARY, NEW BRUNSWICK, CANADA,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Environmental Marine Geology.
M. A. Rashid, and G. E. Reinson.
Estuarine and Coastal Marine Science, Vol 8, No 1, p 23-36, January 1979. 9 fig, 3 tab, 26 ref.

Descriptors: *Organic matter, *Sediments, *Estuaries, On-site investigations, On-site data collections, Circulation, Water circulation, Rivers, Coasts, Carbon, Nitrogen, Particle size, Sampling, Pollutants, Water pollution, Water pollution sources, Sedimentation, *New Brunswick(Canada), *Miramichi Estuary(New Brunswick).

The surficial sediments of the Miramichi estuary, New Brunswick, contain a much higher quantity of organic matter than would be expected to occur in an estuary of this type, shallow and well-mixed. The organic carbon distribution, in general, corresponds with the distribution of fine-grained sediment, although higher concentrations occur in sediments of the drowned river channel than in sediments of the bay portion of the estuary. The high quantity of organics in all the sediments and differences in concentrations between river channel and bay sediments are the direct result of the discharge of pulp-mill effluent into the upper reaches of the estuary. The organic carbon isotopic composition of sediments suggest that land-derived material is the predominant source of organics throughout the estuary. Marine organic material is restricted to the sediments near the estuarine mouth. Dispersal of the organic matter is achieved largely by transport in the upper freshwater effluent layer and by settling through the water column when transport energies are reduced. Settling of organic-matter is highest in areas where deposition of fine-grained inorganics prevails. (Sims-ISWS)
W79-06240

TRITIUM AND CARBON-14 DISTRIBUTIONS IN SEAWATER FROM UNDER THE ROSS ICE SHELF PROJECT ICE HOLE,
Scripps Institution of Oceanography, La Jolla, CA.
R. L. Michel, T. W. Linick, and P. M. Williams.
Science, Vol 203, No 4379, p 445-446, February 2, 1979. 2 tab, 15 ref. NSF DPP76-22134, DPP77-20579, OCE77-17567, EAR76-22623.

Descriptors: *Tritium, *Carbon radioisotopes, *Sea water, *Antarctic, Ice, Cold regions, Isotope studies, Pollutants, Pollutant identification, Circulation, Water circulation, Oceans, Oceanography, *Ross Ice Shelf, *Ross Sea.

The tritium and carbon-14 activities of seawater samples collected from 22 to 200 meters below the ice at the Ross Ice Shelf Project ice hole were reported. The tritium results showed that the waters below the ice have exchanged with Ross Sea water since the advent of nuclear testing. The carbon-14 results indicated that waters in the upper layer exchange in time periods of less than 6 years. Measurements of these isotopes in seawater under the Ross Ice Shelf in McMurdo Sound showed that this water has a different history. (Sims-ISWS)
W79-06241

OCEAN TIDE AND WAVES BENEATH THE ROSS ICE SHELF,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Geological Sciences.
R. T. Williams, and E. S. Robinson.
Science, Vol. 203, No. 4379, p 443-445, February 2, 1979. 2 fig, 1 tab, 12 ref. NSF GV-40434, DPP73-05873.

Descriptors: *Tides, *Waves(Water), *Antarctic, Ice, Ocean waves, Tidal waters, On-site investigations, On-site data collections, Data processing, Oceans, Oceanography, *Ross Ice Shelf, *Ross Sea.

The ocean tide in the southern Ross Sea is principally diurnal. The trophic tide range (double amplitude) is between 1 and 2 meters, depending on the location, and is closely related to the local water-layer thickness. The range of the tropic tide is more than 3 times the range of the equatorial tide. Cotidal and coamplitude charts were made for the largest diurnal constituents, K sub 1 and O sub 1, and a provisional cotidal map was made for the semidiurnal constituent M sub 2. The amplitudes of the diurnal tide constituents are larger in the Ross Sea than in the adjacent southern Pacific Ocean, indicating the existence of a diurnal resonance related to the shape and depth of the sea. Waves related to ocean swell propagate into the ice-covered region from the northern Ross Sea. These waves have amplitudes near 1 centimeter, and periods in the range 1 to 15 minutes. The speed at which these waves travel is successfully predicted by flexural wave theory. (Sims-ISWS)
W75-06242

CIRCULATION AND MELTING BENEATH THE ROSS ICE SHELF,
Lamont-Doherty Geological Observatory, Palisades, NY.
S. S. Jacobs, A. L. Gordon, and J. L. Ardai, Jr.
Science, Vol 203, No 4379, p 439-443, February 2, 1979. 3 fig, 27 ref. NSF C-726, 76-11872, 77-22209.

Descriptors: *Water circulation, *Melting, *Water temperature, *Salinity, *Antarctic, Cold regions, Temperature, Circulation, Density, Ice, On-site data collections, Data processing, Oceans, Measurement, Oceanography, *Ross Ice Shelf.

Thermohaline observations in the water column beneath the Ross Ice Shelf and along its terminal face show significant vertical stratification, active horizontal circulation, and net melting at the ice shelf base. Heat is supplied by seawater that moves southward beneath the ice shelf from a central warm core and from a western region of high salinity. The near-freezing Ice Shelf Water produced flows northward into the Ross Sea. (Sims-ISWS)
W79-06243

WETLANDS PROTECTION: THE REGULATORY ROLE OF THE UNITED STATES ARMY CORPS OF ENGINEERS,
For primary bibliographic entry see Field 6E.
W79-06295

OLD WOMAN CREEK, OHIO: THE DESIGNATION OF A FRESHWATER ESTUARINE SANCTUARY,
Ohio Dept. of Natural Resources, Columbus.
For primary bibliographic entry see Field 6E.
W79-06301

FISHERIES AND WILDLIFE,
California State Dept. of Fish and Game, Menlo Park.
For primary bibliographic entry see Field 5C.
W79-06467

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

MECHANISM AND PREVENTION OF REVERSE OSMOSIS MEMBRANE FOULING,
Midwest Research Inst., Minnetonka, MN. North Star Div.
J. E. Cadotte, and R. J. Peterson.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A053 630, Price codes: A02 in paper copy, A01 in microfiche. September 30, 1977. 3 p. DAAG29-76-C-0053.

Descriptors: *Reverse osmosis, *Desalination, *Desalination processes, *Membrane fouling, *Desalination apparatus, *Membrane processes, *Pollutants, Colloids, Pollutant identification, Flocculation, Filtration, Clays, Chlorine, Organic compounds, Inorganic compounds, Water treatment, Water purification.

Information concerning the deposits which foul reverse osmosis membranes is abstracted from two unpublished papers. Testing revealed that colloidal and dissolved constituents of naturally occurring surface waters were the cause of membrane fouling. Although clays and inorganic colloids are easily removed from feedstreams by polymeric flocculation and sand filtration the organic colloids are more difficult to remove. The surface analysis techniques, electron spectroscopy, Auge electron spectroscopy, and scanning electron microscopy, were used to characterize membrane deposit from Potomac River water and sea water feeds. The three approaches selected to reduce membrane fouling were: (1) improvement in pretreating the feedwater; (2) complexing the organic colloids with the addition of cationic polymers to the feed water; and (3) modification of the membrane surface to decrease the adherence of the foulants. Effort was concentrated on the first method. The pretreatment process involves the addition of an organic polymer flocculating agent followed by sand filtration. Alum and ferric chloride, coagulating agents, were used in conjunction with organic polymer flocculants; ferric chloride appeared better for removing organic colloids from river water. A pretreatment process for river water was developed in which the raw water was pretreated with 10 ppm of chlorine and 10 to 50 ppm of chlorine and 10 to 50 ppm ferric chloride. The pH of the water was adjusted to 5.5 with sulfamic acid which complexed the chlorine so that it did not oxidize the membrane. (Davison-IPA)
W79-06079

RESEARCH ON AND DEVELOPMENT OF ION-SELECTIVE AND ION-SPECIFIC MEMBRANES FOR USE IN THE LARGE-SCALE, LOW-COST DEMINERALIZATION OF SALINE WATERS BY SELECTIVE ELECTRODIALYSIS.
Polytechnic Inst. of New York, Brooklyn.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 694, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 37, May 1960. 77 p, 6 fig, 11 tab, 35 ref. 14-01-001-62.

Descriptors: *Desalination, *Desalination apparatus, *Membranes, *Membrane processes, Permeability, Fabrication, Ion transport, Specific retention, Laboratory tests, Selectivity, Diffusion, Sulfates, Ions, Chlorides, Distillation, Electrodialysis, Separation techniques, Water treatment, Desalination processes, Water purification, Saline water, Brackish water.

An investigation of known membrane systems which might be more permeable to sulfate than to chloride, and the attempt to prepare membranes of improved specificity are reported. A membrane of improved specificity would be useful in removing sulfate from a chloride-sulfate solution in which the sulfate content is too high, or to fractionate a mixture of the ions into two solutions with each solution containing only one ion. The commercial membranes, Nalfilm 2 and Nalfilm 4 were investigated. Compounds presumed to be specific to sulfate were utilized in the preparation of membranes with improved specificity. Impregnated membranes made from o-phenylene-diamine and benzidine and polymerized on Polypor PVA formaldehyde were tested along with four hetrogeneous membranes prepared with anion exchange resins in a Dynel matrix. The tests to determine specificity included measurements of the bi-ionic potentials, conductance, selectivity ratios, diffusion coefficients, and direct measurement of the transport numbers in brackish water. The resulting data is tabulated. Although the tests indicated that membranes can be prepared from material specific to sulfate, the membranes showed no transport specificity. The technique of preparing a sulfate specific membrane by incorporating Benzidine-Formaldehyde in an inert matrix was insufficient because the resin bound the sulfate too strongly. (Davison-IPA)
W79-06082

DEVELOPMENT OF THE ZONE-PURIFICATION PROCESS FOR PREPARING POTABLE WATER FROM SEA WATER,
Battelle Memorial Inst., Columbus, OH.
W. H. Mink, G. F. Sachsel, and R. B. Filbert, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 766, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 39, June 1, 1960. 30 p, 10 fig, 2 tab, 4 append. 14-01-001-175.

Descriptors: *Desalination, *Desalination processes, *Desalination apparatus, *Zone-purification process, *Freezing, Economics, Estimated costs, Computer models, Sea water, Potable water, Analog models, Water purification, Water treatment, Separation techniques, Tubes, Refrigeration, Temperature control.

The vertical-tube zone-void refiner was selected as the apparatus in which the zone-purification process could operate in a continuous manner. In this unit a number of vertical tubes pass through closely spaced, horizontal plates. With the spaces between the plates connected by automatic values to either the heating or cooling part of a refrigeration system, it is possible for any space to be a melting or freezing zone. The freezing and melting zones move upward along the tube by selective operation of the valves. As the sea water introduced near the top of the tube passes down the tube, it is subjected to a zone purification as it passes a freezing zone. Purified water leaves the bottom of the tube, and salt is concentrated as brine at the top to be periodically removed by flushing with fresh sea water. Information obtained from an analog computer simulation of the unit and additional experimental freezing data show that the optimum vertical-tube would require four stages, freeze 13% of the feed, and require a temperature difference in the freezing zones of 3F. The estimated capital costs for plant producing 100,000 gallons of potable water/day were $2,600,000, with operating costs estimated at $9.60/1000 gallons of potable water. Capital and operating costs for a 10 million gpd plant were estimated at $115,000,000 and $4.21/1000 gallons, respectively. It is concluded that these costs are not likely to be reduced with major changes in the process. (Davison-IPA)
W79-06083

DEVELOPMENT, CONSTRUCTION, AND TESTING OF OSMIONIC DEMINERALIZERS,
Southern Research Inst., Birmingham, AL.
R. E. Lacey, E. W. Lang, and C. E. Feazel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 862, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 38, June 1960. 94 p, 26 fig, 11 tab, 8 ref. 14-01-001-88.

Descriptors: *Desalination, *Desalination processes, *Desalination apparatus, *Osmionic demineralizers, Testing, Laboratory tests, Equations, Membranes, Membrane processes, Physical properties, Physicochemical properties, Materials, Demineralization, Cost comparisons, Estimates costs, Separation techniques, Water treatment, Water purification, Brackish water.

Two bench-scale demineralizers based on the osmionic process were developed to determine whether these units could be built by methods amenable to mass production, and whether the demineralization rates obtainable in such units are rapid enough to be of practical interest. In Part A the important results of the project are summarized

and the current status of the osmionic process is reported. In Part B the work is discussed in detail. Alterations in the original Murphy Design equations are discussed and the electrochemical and physical properties of osmionic membranes are examined. The following special testing programs important to the design of osmionic units are discussed: (1) testing of bonds between membranes; (2) polarization or boundary-layer effect; (3) pressure drop and solution distribution within membrane compartments; (4) evaluation of gasket materials for the second bench-scale demineralizer; and (5) leakage of ions through membranes. Details of both bench-scale demineralizers are given. The estimated costs of demineralization based on the osmionic process appear to be competitive with those of other processes. (Davison-IPA)
W79-06084

EVALUATION OF THE ZONE-PURIFICATION PROCESS AS A METHOD OF PREPARATION OF POTABLE WATER FROM SEA WATER,
Battelle Memorial Inst., Columbus, OH.
R. C. Himes, S. E. Miller, W. H. Mink, and H. L. Goering.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 818, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 36, May 1960. 32 p, 8 fig, 5 tab. 14-01-0001-80.

Descriptors: *Desalination, *Desalination processes, *Zone-purification process, *Freezing, *Ice-water interfaces, Interfaces, Crystal growth, Crystallization, Demineralization, Equipment, Mechanical equipment, Saline water, Potable water, Evaluation, Separation techniques, Water purification, Water treatment.

Continuing work is reported in understanding the phenomena which occur during freezing to establish optimum conditions for segregation of salt and to determine the most suitable conditions for large scale utilization of the zone purification process. Studies on water-ice interface shape were concentrated on the investigation of mechanical stirrers and a continuous flow-type apparatus for providing fluid measurement near the interface. These studies have shown that the shape of the interface is important in determining the nature of the ice deposited. High segregation efficiency was obtainable by promoting the growth of ice crystals from the center of the freezing tube toward the periphery in place of the normal growth which is inward from the periphery. Experimental details are given for studies on interface shape, rate of crystallization of ice from salt solutions, microscopic examination of pulled ingots, constitutional super cooling, multiple-stage freezing, efficiencies of segregation in multiple-stage freezing and crystal-pulling experiments. Preliminary engineering evaluation and detailed engineering treatment are discussed. It is concluded that periodic salt entrapments are linked with breakdown of constitutional supercooling. The technical feasibility of multiple-stage zone-freezing conversion of sea water was demonstrated, and perhaps the vertical tube system of the several multiple-stage continuous freezing systems evaluated may be economically feasible. (Davison-IPA)
W79-06085

FURTHER DEVELOPMENT OF A DIRECT-FREEZING CONTINUOUS WASH-SEPARATION PROCESS FOR SALINE CONVERSION,
Carrier Corp., Syracuse, NY.
C. M. Bosworth, S. S. Carfagno, A. J. Bardhun, and D. J. Sandell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 403, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 32, July 1959. 78 p, 15 fig, 7 tab, 8 append. 14-01-001-86.

Descriptors: *Desalination, *Desalination processes, *Freezing, Laboratory tests, Equipment, Costs, Capital costs, Operating costs, Water costs, Separation techniques, Desalination apparatus, Design criteria, Water treatment, Water purity.

An experimental program is reported wherein the operational variables of a direct freezer and wash separation column are determined for the purpose of designing a pilot plant. Recent modifications to the experimental equipment resulted in an increased capacity of about 400 gpd with an acceptable amount of wasted wash water. Project activity is reported for September 1 to November 30, 1958 and activity for period October 15, 1957 to November 30, 1958 is summarized. Experimental freezing and separation results are presented. A pilot plant using an absorption refrigeration machine for water vapor removal was designed to produce 15,000 gpd of fresh water from sea water. Total estimated costs for fabrication, assembly and leak testing is $150,000. Estimated capital costs are presented for single effect plants with capacities of 15,000 gpd, 100,000 gpd, 500,000 gpd, and 10,000,000 gpd. The cost of water produced by these plants was estimated to be economical with steam available at $.25 or less/MBtu and $.55/MBtu, or electrical power available at $.007/kwhr. The single effect absorption machine is expected to produce less expensive water than the three effect machine if waste steam cost is less than $.15/MBtu. (Davison-IPA)
W79-06086

THIN FILM VAPOR COMPRESSION SALINE WATER CONVERSION SYSTEM,
Westinghouse Research and Development Center, Pittsburgh, PA.
A. Willenbrock, Jr., R. M. Chamberlin, D. R. Fraser, G. E. McGinnis, and J. A. Cyphers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 582, Price codes: A15 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 85, February 1964. 323 p, 104 fig, 13 tab, 17 ref, 5 append. 14-01-0001-273.

Descriptors: *Desalination, *Desalination processes, *Desalination plants, *Thin film vapor compression, Evaporation, Thin films, Heat transfer, Technology, Economics, Cost comparisons, Materials, Separation techniques, Water treatment, Water purification, Saline water.

A research and development program is reported wherein the critical areas of a proposed thin film vapor compression system were examined and evaluated. The five tasks involved in the program included: (1) determining the characteristics of an adequate saline water evaporating film flowing on a vertical or nearly vertical flat surface; (2) developing the technology to create and maintain this film; (3) determining of minimum cost materials consistant with environment, life and manufacturing requirements; (4) developing improvements in heat transfer by specially formed surfaces; and (5) evaluating the manufacturing techniques in fabricating the heat transfer surface. The technical assumptions were verified experimentally; the required developments were accomplished; the economic assumptions were studied and reevaluated; and the technology was attained to design a pilot plant. It is concluded that a one million gpd thin film vapor compression sea water conversion system could be built which would produce water at comparable costs of current multi-stage flash plants. (Davison-IPA)
W79-06087

CONTINUATION OF MATERIALS EVALUATION PROGRAM,
Rice (Cyrus William) and Co., Pittsburgh, PA.
H. C. Bramer, W. E. Bell, R. E. Moore, D. R. Surdock, and D. R. Brenneman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-201 020, Price codes: A13 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 535, March 1970. 283 p, 34 fig, 32 tab, 14 ref, 1 append. 14-01-0001-1657.

Descriptors: *Desalination, *Materials Evaluation Report Form, *Desalination apparatus, *Materials testing, *Evaluation, *Information retrieval, Corrosion, Tubes, Steel pipes, Linings, Coatings, Plastic, Rubber, Laboratory tests, Water treatment, Separation techniques, Desalination plants.

The on-going testing of construction materials and equipment at test bed plants and other facilities operated by the Office of Saline Water Research is reported. In response to the need for a centralized and coordinated program for reporting corrosion information, the Materials Evaluation Report Form (MERF) was developed. This complete information handling and retrieval system for the information generated during field inspections, from nondestructive testing, from corrosion testing in the laboratory, from laboratory analyses, and other sources is described. Details of testing in the following areas are given: tubing materials in all test bed plants, corrosion specimens in side stream loops, corrosion deposition as a function of dissolved oxygen, and carbon steel erosion-corrosion. Selected tubing materials in all test bed plants were tested using the Probolog Instrument. In high maintenance areas requiring frequent repair and replacement carbon steel piping the use of fiberglass reinforced plastic piping and plastic lined light gauge steel or aluminum piping seems economically justified. Recommendations are made for further research in these areas and the area of waterside technology as related to saline water conversion equipment performance. (Davison-IPA)
W79-06088

FABRICATION OF SMOOTH TUBES FOR LARGE MULTISTAGE FLASH EVAPORATOR DESALINATION PLANTS,
Oak Ridge National Lab., TN.
F. J. Moran.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-201 024, Price codes: A09 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 540, March 1970. 176 p, 25 fig, 7 tab, 3 ref, 6 append. 14-01-0001-534.

Descriptors: *Desalination apparatus, *Tubes, *Fabrication, *Industrial production, *Copper alloys, Desalination processes, Multiple-stage flash evaporation, Titanium, Water treatment, Water purification, Separation techniques, Desalination.

A study with the following objectives is presented: (1) to ascertain the present state of the art of fabricating copper-nickel and titanium alloy condenser tubing and (2) to stimulate industry development of improved methods. The scope involved performing a continuous evaluation of the state of the art; developing specifications for fabricating reliable low-cost tubing; evaluating improved methods for fabricating seamless and welded tubes; and surveying eddy-current and ultrasonic types of tube testing instruments, and determining their suitability for high-speed, in-line testing of smooth tubes for desalination plants. The state of the art has remained static because the market for condenser tubes has not been large enough to justify the capital investment needed to produce copper-alloy tubes by the most advanced methods, and because the relatively short lengths required in heat exchanges could be produced on conventional draw benches keeping the more efficient production units occupied with supplying the growing demand for unalloyed copper tubing. The production methods, limitations and costs of copper-alloy tube production are summarized. The development of improved production of copper-nickel tubes, and its estimated costs are discussed. Welded tube fabrication, quality control, specifications for copper-nickel tubing for multi-stage flash (MSF) plants, splicing of tubes for use in MSF plants, improved production processes for titanium tubes, and welding of titanium tubes to titanium-clad steel tube sheets are examined. (Davison-IPA)
W79-06089

AN INVESTIGATION OF THE TRANSPORT PROPERTIES OF ION EXCHANGE MEMBRANES,
Little (Arthur D.) Inc., Cambridge, MA.
J. H. B. George.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-179 945, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 159, December 1965. 36 p, 2 fig, 13 tab, 10 ref. 14-01-0001-372.

Descriptors: *Desalination, *Membrane processes, *Cation exchange, *Conduction, Conductivity, Transfer, Water conveyance, Activation energy, Measurment, Temperature, Aqueous solutions, Testing, Testing procedures, Water treatment, Water purification, Separation techniques.

Experimental data on the specific conductance of a polystyrene-sulfonate cation exchange membranes and water transfer accompanying the passage of ions through the membrane are presented. The conductance measurements were carried out at 10, 25, and 40C; equivalent conductances and energies of activation were calculated for the conduction process. It was found that equivalent conductances of ions in the membranes are lower than the corresponding values in free aqueous solution; the effect is much greater for multivalent ions. Water transfer measurements were made under conditions corresponding to those used for conductance measurements. Although water transfer/equivalent varied correspondingly with charge type, the water transfer/mole of ion showed similar values for all ions studied, except the heavily hydrated lithium ion which showed larger values. Water transfer, independent of temperature for monovalent ions, decreased with temperature for divalent and trivalent ions. The data were combined with estimated values for ionic self-diffusion coefficients in the membrane to calculate friction coefficients for the interactions between membrane, counterion, and water. The usefulness of the numerical values is limited by assumptions which must be made in the derivation. (Davison-IPA)
W79-06090

REVERSE OSMOSIS MEMBRANE RESEARCH,
General Atomic Co., San Diego, CA.
V. Merten, H. K. Lonsdale, R. L. Riley, and K. D. Vos.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-180 322, Price codes: A09 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 265, August 1967. 197 p, 54 fig, 44 tab, 76 ref, 1 append. 14-01-001-767.

Descriptors: *Desalination, *Desalination apparatus, *Reverse osmosis, *Membranes, *Membrane processes, Thin films, Semipermeable membranes, Compaction, Cellulose acetate, Polymers, Ion transport, Water purification, Water treatment, Separation techniques, Brackish water, Plastics, Saline water.

Several areas of research on the properties and performance of cellulose acetate membranes in reverse osmosis desalination, and the development and evaluation of improved membranes are summarized. The two significant limitations of the use of modified cellulose acetate membranes, membrane compaction and lifetime, were studied. The study of the decline in water flux with time indicates that flux decline probably results from morphological changes in membrane substructure. Membrane life studies conducted on simulated brackish water and on San Diego tap water allow predictions of membrane life to be tested based on previous studies of the pH-dependence of the hydrolysis rate of cellulose acetate. In studies of the thin-film method for preparing high-flux cellulose acetate membranes, two membranes produced with no imperfections exhibited 99.8% sodium chloride rejection. Attention was concentrated on the interpolymer of ethyl cellulose and polyacrylic acid and ion exchange membranes in the study of alternate membrane materials. The study of models of transport phenomena in membranes includes coupled flow in solution-diffusion membranes and the finely-porous, fixed-charge membrane. Immersion, direct osmosis, and reverse osmosis experiments show that phenol and water are strongly coupled in flowing through cellulose acetate membranes. Negative rejection of phenol was observed in reverse osmosis. (Davison-IPA)
W79-06091

DISPOSAL OF THE EFFLUENTS FROM DESALINATION PLANTS: THE EFFECTS OF COPPER CONTENT, HEAT AND SALINITY,
Dow Chemical Co., Midland, MI.
M. A. Zeitoun, E. F. Mandelli, W. F. McIlhenny, and R. O. Reid.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-203 857, Price codes: A10 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 437, March 1969. 203 p, 40 fig, 56 tab, 110 ref, 5 append. 14-01-0001-1161.

Descriptors: *Desalination, *Effluents, *Desalination wastes, *Environmental effects, *Temperature, *Salinity, *Copper, Phytoplankton, Diatoms, Dinoflagellates, Heat, Water treatment, Separation techniques, Physical properties, Chemical properties, Sea water, Desalination plants.

In estimating the ranges in chemical and physical properties of the effluents from large dual-purpose plants, the copper concentration in the effluents, the dispersion of effluents in the marine environment, and the ecological effects of the effluents were studied. Through analysis of the process streams of three desalination plants it was found that copper was more soluble in sea water concentrates than in sea water, with a minimum solubility at pH 7.5. Since the mixed effluent from a desalination plant is more dense than the receiving water, it tends to sink to the ocean floor. The theoretical aspects of a vertical jet of dense fluid were studied numerically and analytically. Experimental results obtained through using a laboratory model indicate that a dissolved constituent of the jet fluid would spread more rapidly in the lateral direction inside the core of the jet than momentum, and the constituent would spread more slowly than momentum in the outer region. Increasing temperatures in coastal waters tend to produce a simplification of the phytoplankton structure of the environment. A continuous supply of copper concentrations of about 0.05 ppm at 20C was found to be toxic to diatoms and dinoflagellates. Increasing temperatures increased the toxicity of copper to marine phytoplankton, while increasing salinities were found to have an antagonistic action on the toxicity of copper to them. (Davison-IPA)
W79-06092

PILOT PLANT TESTS AND DESIGN STUDY OF A 2.5 MGD HORIZONTAL-TUBE MULTIPLE-EFFECT PLANT.
Universal Desalting Corp., New York.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-200 905, Price codes: A09 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 492, October 1969. 156 p, 35 fig, 6 tab, 15 ref, 3 append. 14-01-0001-1707.

Descriptors: *Desalination, *Desalination plants, *Desalination processes, Horizontal tube multiple effect distillation, Evaluation, Heat transfer, Feasibility, Costs, Operating costs, Capital costs, Water costs, Water treatment, Water purification, Separation techniques, Design criteria, Wrightsville Beach(North Carolina).

In a new concept of multiple effect distillation equipment, the heat transfer tubes are horizontal with steam condensing on the inside and brine boiling on the outside; the effects are arranged vertically. The extensive tests conducted at the Wrightsville Beach, North Carolina, pilot plant show that the smooth horizontal tubes yield heat transfer coefficients which are 50 to 100% higher than those of smooth vertical tubes; however, the vertical arrangement with gravity flows eliminates all intereffect pumps and associated equipment. Design parameters were determined using this concept, and a 2,500,000 gpd plant was designed in sufficient detail to prepare reliable cost estimates. The total installed capital cost is $1,625,500, capital cost/gallon stream day is $.65, and operating cost/1000 gal is $.537. Detailed drawings of the 2.5 MGD horizontal tube multiple effect plant are provided. (Davison-IPA)
W79-06093

DEVELOPMENT OF PRECIPITATION PROCESSES FOR REMOVAL OF SCALE FORMERS FROM SEA WATER.
Grace (W. R.) and Co., Clarksville, MD. Washington Research Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-185 171, Price codes: A21 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 192, May 1966. 487 p, 86 fig, 143 tab, 22 ref, 11 append. 14-01-0001-323.

Descriptors: *Desalination, *Desalination process, *Evaporation, *Precipitation(Chemical), *Pretreatment(Water), Scaling, Phosphates, Calcium carbonate, Lime, Calcium compounds, Fertilizers, Phosphorus compounds, Separation techniques, Water treatment, Water purification, Water quality, Water quality control, Desalination apparatus.

The Wrightsville Beach pilot plant equipment was used to verify the laboratory work which developed the phosphate precipitation for removing calcium from sea water and producing a phosphatic byproduct raw material for the manufacture of fertilizer. The lime-magnesium carbonate (LMC) process for removing calcium from sea water was also tested on this equipment. Each process is described and, the laboratory studies and pilot plant operations for both are examined; the by-product of the phosphate precipitation process is evaluated. Capital and manufacturing costs for both processes are discussed, as well as for byproduct recovery. It was shown that it is technically feasible to precipitate out all the magnesium and up to 99% of the calcium present in sea water by phosphate precipitation on a continuous pilot plant basis. It was also shown by pilot plant operation that the addition of magnesium carbonate trihydrate in the presence of calcium carbonate seeds, followed by lime, will precipitate up to 65% of calcium from sea water. It is concluded that in a single effect, forced circulation evaporator operating at 275F and 7/1 brine concentration, water treated by phosphate precipitation produced absolutely no scale; negligible deposits of calcium carbonate occurred, but a light coating of Mg(OH)2 and CaSO4 anhydrite was deposited in the heater tubes when sea water treated with calcium was fed to a single effect, forced circulation evaporator for 500 hours at 270F and 1.9 concentrations. (Davison-IPA)
W79-06094

WET-END SHOWERS AND WHITE WATER SHOWER SYSTEM CONSIDERATIONS,
Albany Engineered Systems, Glens Falls, NY.
H. R. Bissell.
Tappi (Atlanta, GA) Seminar Notes on Wet-End Operations, New Orleans, May 14-19, 1978, p 97-103. 1 appendix, 3 fig, 5 ref.

Descriptors: *Water reuse, *White water(Paper machines), Water pollution sources, Pulp wastes, Recycling, Industrial water, Pulp and paper industry, Effluents, Water conservation, Operation and maintenance, Corrosion control, Scaling, Slime, Filters, Valves, Pipelines, Storage tanks, Paper machines, Showers, Closed systems.

An important aspect of closing the paper-machine water system is the increased use of recycled water in shower sprays. Operating problems of such showers involve plugging or clogging of nozzles. Showers specifically designed for minimizing such troubles (self-cleaning or purgeable nozzles) are described, along with other components of the white water recirculation system (gravity strainers, white water chests or tanks, piping, flush valves, in-line pressure filter, etc.) and maintenance considerations (for control of corrosion, scale, and slime deposits). (Brown-IPC)
W79-06117

SALINE WATER CONVERSION BY DIRECT FREEZING WITH BUTANE,
Blaw-Knox Co., Pittsburgh, PA.
G. Karnofsky, and P. F. Steinhoff.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 819, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 40, July 1, 1960. 67 p, 16 fig, 9 ref. 14-01-001-176.

Descriptors: *Desalination, *Desalination processes, *Desalination plants, *Freezing, *Cornell process, *Economics, Costs, Estimated costs, Engineers estimates, Capital costs, Water costs, Water treatment, Separation techniques, Water purification, Sea water.

Laboratory work is the basis for an engineering study of a 10,000,000 gpd plant to produce fresh water from sea water using a system known as the Cornell Process. In this process, direct freezing is brought about by evaporation of a hydrocarbon refrigerant, butane, in contact with sea water. The ice is washed free of saline liquor, and then melted to potable water by the condensation of butane vapor. The total estimated cost for a plant utilizing electric drive is $10,524,000; product water cost is $.555/1000 gallons. For a plant using gas engines for the compressors, the capital investment is $11,874,000; product water cost is $.507/1000 gallons. While brackish water was not considered it is estimated that the cost of converting it would be $.10 less/1000 than sea water conversion. The engineering design is based on laboratory work which closely imitated a large scale operation. A flow diagram includes every major equipment item necessary in a complete plant. (Davison-IPA)
W79-06268

SOLAR STILL CONSTRUCTION,
New York Univ., NY. Engineering Research Div.
M. Telkes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 404, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 33, August 1959. 21 p, 4 fig, 1 tab. 14-01-001-68 and 14-01-001-102.

Descriptors: *Desalination, *Desalination apparatus, *Solar distillation, *Solar stills, *Evaporation, Equipment, Design criteria, Structural design, Fabrication, Water yield, Efficiencies, Separation techniques, Water treatment, Water purification, Saline water, Solar radiation.

Specification and designs of the glass covered flat, tilted solar still and a multiple effect solar still are presented. The structural components and operation of the stills are described. Tilted surfaces receive more solar radiation than horizontal surfaces. The optimum year around tilt is equal to the geographical latitude. At the Office of Saline Water test installation in Daytona Beach, Florida, a tilt of 25 degrees from the horizontal facing south is most favorable. Theoretically, the maximum water yield is computed by using the factor of 1070 Btu/lb of water and assuming a 100% efficiency of the total solar energy used for evaporation. This efficiency cannot be attained by single effect stills because of inherent losses in transmission and operational heat loss, and heating of excess feed water. The multiple effect still presented combines the collection of solar energy with a 10 effect still tilted at 25 degrees from the horizontal. It is estimated that the efficiency of the 10 effect still is six times greater than a single effect of equal solar energy intercepting area. Drawings of the flat tilted still and the multiple effect still are provided. (Davison-IPA)
W79-06269

REMOVAL OF SCALE-FORMING COMPOUNDS FROM SEA WATER,
Grace (W. R.) and Co., Clarksville, MD.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 406, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 66, September 1962. 100 p, 19 fig, 44 tab, 36 ref. 14-01-001-202.

Descriptors: *Desalination, *Pre-treatment(Water), *Descaling, *Fertilizers, Ammonium compounds, Phosphates, Scaling, Economic feasibility, Sea water, Trace elements, Water analysis, Water chemistry, Water treatment, Desalination plants, Research and development, Water quality, Water quality control, Distillation.

An investigation was undertaken to determine the economic feasibility of preparing a high analysis fertilizer from the scale-forming elements removed in the pretreatment of raw sea water, and to determine the ore potential of sea water. Magnesium, calcium and the trace elements, iron, zinc, copper, manganese and cobalt were precipitated from sea water as metal ammonium phosphates and other phosphates with phosphoric acid and ammonia. The descaled sea water was ready to be used in a water conversion plant. The slurry of precipitated solids, i.e., fertilizer was dehydrated by heating, then filtered, washed, granulated and dried. This fertilizer has low solubility, is non-burning, non-leaching and long acting. Assuming a descaling of one mgpd capacity the fertilizer produced would have to command a price higher than that of conventional fertilizers unless a reduction in the cost of raw materials is achieved through technological improvements. It is anticipated that various other metals will eventually be separated from sea water or the waste evaporator brine. Future metal recovery processes may utilize the fertilizer produced by this process as a raw material. (Davison-IPA)
W79-06270

EFFECTS OF IMPRESSED ELECTROSTATIC FIELDS ON THE SALT WATER/AIR INTERFACE,
Tracor, Inc., Austin, TX.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 407, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 67, September 1962. 54 p, 18 fig, 2 tab, 20 ref. 14-01-001-200.

Descriptors: *Desalination, *Desalination processes, *Electrophoresis, Interfaces, Boundaries, Air-water interfaces, Separation techniques, Measurement, Surface tension, Drops, Electrodes, Desalination apparatus, Salinity, Saline water, Impressed electrostatic fields, Water treatment, Water purification.

Surface tension changes were measured after electrostatic fields of up to 6700 v/cm, positive and negative, were applied to air/NaCl-solution interfaces; salt concentration ranged from 0 to 3.5%. The surface tension of all solutions investigated was lowered by both field directions, with the positive air electrode lowering the surface tension of pure water less than a negative air electrode. It now appears that the field at the air-water interface is smaller than the 10 to the seventh vcm previously thought present, that the orientation of the water dipoles at the interface is slight, and that the predominant small orientation present is with the hydrogen atoms facing the air. Data from calculating the surface deficiency of NaCl solutions under applied electric fields with the Gibbs equation show that a positive air electrode increases the surface deficiency and a negative air electrode decreases it. An attempt to use a skimming apparatus to measure directly the surface concentration change revealed that its usefulness depended on the ability to analyze the skimmed and unskimmed position with accuracy. This was not possible for NaCl solutions up to 3.5%. It is concluded that surface concentration changes of NaCl solutions due to applied electrostatic fields are too small to be measured quantitatively and are unsuitable for practical desalination processes. (Davison-IPA)
W79-06271

TEMPERATURE DISTRIBUTION IN THE CRYSTALLIZATION OF UNDERCOOLED LIQUIDS IN CYLINDRICAL TUBES,
Massachusetts Inst. of Tech., Cambridge.
P. L. T. Brian, and P. R. Sperry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 673, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 98, May 1964. 50 p, 6 fig, 3 tab, 13 ref, 5 append. 14-01-0001-295.

Descriptors: *Desalination, *Crystallization, *Temperature, *Ice-water interfaces, Boundaries(Surfaces), Boundary layer, Crystals, Growth rate, Nucleation, Supercooling, Separation techniques, Laboratory tests, Heat transfer, Equations, Numerical analysis, Water treatment, Water puification.

An analysis of the planar interface morphology observed in capillary crystallization experiments is discussed. One technique for determining crystallization kinetics of undercooled liquids consists of nucleating a seed crystal with the desired crystallographic orientation in one end of a capillary tube filled with the liquid under investigation. After nucleation the preparation is placed in a bath held at a constant temperature below the equillibrium freezing point of the liquid. The rate of crystal growth is determined by measuring the position of the solid-liquid interface as a function of time. When the temperature of the cooling bath is adjusted to correspond to various degrees of supercooling the curve showing the dependence of growth rate of the crystal face on undercooling can be obtained with one seed crystal. The temperature at the crystal-liquid interface is greater than the temperature of the cooling bath, because the latent heat of fusion is liberated at the interface during crystal growth. A planar interface for crystals growing normal to the hexagonal basal plane was observed. Numerical values of interface temperature rise as a function of the parameters of the capillary crystalization experiment are presented. (Davison-IPA)
W79-06272

RESEARCH ON SALINE WATER CONVERSION BY FREEZING,
Massachusetts Inst., of Tech., Cambridge.
T. K. Sherwood, and P. L. T. Brian.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 593, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 96, March 1964. 52 p, 14 fig, 20 ref. 14-01-0001-295.

Descriptors: *Desalination, *Desalination processes, *Freezing, *Laboratory tests, Laboratory equipment, Membranes, Crystallization, Mathematical studies, Ice-brine interfaces, Saline water, Salinity, Water treatment, Water purification, Separation techniques.

The progress of three investigations in the research related to freezing as a desalination process are reported: (1) a study of the effect of salt build-up at a phase boundary across which water only is removed from brine; (2) an experimental and theoretical study of counter-current washing to remove brine from ice-brine 'slush'; and (3) a basic study of the effect of additives on crystallization of supercooled water. In an experimental study of the salt buildup phenomena, a porous hollow rotating cylinder coated with an osmotic membrane is used to separate water from salt solution with pressure applied to the external salt solution. Two preliminary experiments made with cellulose acetate membranes showed that the equipment operated satisfactorily. The washing investigations carried out on glass and plastic beads and batch washing of brine from a mass of small ice crystals are described. A summary of mathematical analysis of experiments to determine the interface temperature in capillary crystallization experiments is presented. Background information in these areas from the literature is discussed. (Davison-IPA)
W79-06273

STUDY OF MULTI-PHASE EJECTORS FOR DISTILLATION DESALINATION SYSTEMS,

Kaye (Joseph) and Co., Inc., Cambridge, MA.
C. A. Kemper, G. F. Harper, S. W. Gouse, and J. H. Leigh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 594, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 97, January 1964. 80 p, 25 fig, 9 ref, 3 append. 14-01-0001-329.

Descriptors: *Desalination, *Desalination processes, *Evaporation, *Multi-phase ejectors, Physical properties, Temperature, Energy, Differential thermal analysis, Friction, Viscosity, Pumps, Performance, Vapor compression distillation, Water treatment, Water purification, Separation techniques.

The results of this detailed, theoretical study of single stage evaporation system incorporating a multi-phase ejector (MPE) to achieve the driving temperature difference, can be interpreted in terms of various vapor evaporation systems or various freezing systems. Evaporator temperatures of 150 to 350F and evaporator temperature differences of 5 and 10F were used, and the effects of pump efficiency, viscous friction, and mixing irreversibility in the MPE were considered. For given operating conditions pure work-input MPE desalination systems were the most attractive from an overall energy requirement basis when 25% efficiency was assumed for the heat engine producing the required work-input. Upon examining the possibility of staging various types of MPE desalination systems, it was found that pure work-input systems would most likely be operated as single stage systems. The results of comparing an ideal pure work-input MPE system and a reversible adiabatic vapor compression system indicate that the MPE system is more attractive on a work-input basis. Economically, it would be less costly to replace the liquid pump of the MPE system than to replace a vapor compressor. MPE desalination systems are described, and the analytical methods used, and discussions of the results are presented in the appendices. (Davison-IPA)
W79-06274

SALT CONCENTRATION AT PHASE BOUNDARIES IN DESALINATION PROCESSES,
Massachusetts Inst. of Tech., Cambridge.
T. K. Sherwood, P. L. T. Brian, and R. E. Fisher.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 592, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 95, March 1964. 51 p, 8 fig, 2 tab, 16 ref, 1 append. 14-01-0001-295.

Descriptors: *Desalination, *Desalination processes, *Salt build-up, Membranes, Membrane processes, Reverse osmosis, Osmosis, Osmotic pressure, Flow, Mass transfer, Boundary processes, Boundaries(Surfaces), Flow resistance, Flow separation, Laminar flow, Turbidity, Separation techniques, Water treatment, Water purification.

The theory of the salt build-up phenomena is examined. Salt build-up can be serious in water removal by freezing, solvent extraction and reverse osmosis. When occurring at the surface of an osmotic membrane, it causes the effective osmotic pressure to be greater than the osmotic pressure of bulk brine, and the operating total pressure must be increased by this increment to maintain the desired water withdrawal flux. The importance of salt build-up can be estimated using the existing theories of diffusion and mass transfer. Such estimates for turbulent and laminar flow of brine past the surface of an osmotic membrane are presented. An analysis of these suggests that the salt build-up phenomena can be a serious obstacle to the development of reverse osmosis desalination processes. An analysis for constant water flux in the case of flow in a two-dimensional duct develops the relations expressing the salt concentration as a function of membrane spacing, duct length, and brine flow velocity for all positions in the channel. Numerical examples show that salt build-up may not be serious for high brine velocities with modest water removal rates. However, salt build-up at the surface of reverse osmosis membranes is serious even with the modest water fluxes attainable with present-day membranes. With the development of better membranes which permit greater water production rates, the salt build-up phenomena will become increasingly important. (Davison-IPA)
W79-06275

RESEARCH AND DEVELOPMENT OF BADGER-HICKMAN CENTRIFUGAL DISTILLATION TECHNIQUES AND EQUIPMENTS.
Badger Co., Inc., Cambridge, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 387, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 12, November 1956. 84 p, 33 fig, 7 tab. 14-01-001-65.

Descriptors: *Desalination, *Desalination apparatus, *Desalination processes, *Destillation, *Evaporation, Heat transfer, Design criteria, Laboratory tests, Sea water, Water treatment, Separation techniques, Water purification.

The development and operation of the vapor-compression distillation apparatus for saline water, Number 3 and Number 4 machines, are discussed. These machines are based on the principle of high-velocity flow of thin films of water over the heating surfaces at temperatures below the limit of scale forming. Machine Number 3 was constructed with 18 inch rotors. Heat transfer efficiency was demonstrated on sea water in a test run of over 300 consecutive hours. Machine Number 4 using five foot diameter disks was constructed and operated on sea water and tap water to extend and confirm the information obtained on the smaller machines and to explore the effect of increasing size on the practicability and efficiency of centrifugal evaporator recompression stills. Data from the tests of both machines is presented in tabular form. Engineering designs for a 25,000 gpd unit were developed based on the investigations of the Number 3 and Number 4 machines. Sketches of the design and a description of the process are presented. The investigations demonstrated that heat transfer rates five to seven times as high as those of sea water evaporators can be maintained. This type of thermocompression equipment has the potential to distill water with about one half the fuel requirement of conventional vapor-compression equipment. (Davison-IPA)
W79-06276

NEW AGENTS FOR USE IN THE HYDRATE PROCESS FOR DEMINERALIZING SEA WATER,
Syracuse Univ., NY. Dept. of Chemical Engineering and Materials Science.
F. A. Briggs, Y. C. Hu, and A. J. Barduhn.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 143, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 59, March 1962. 44 p, 8 fig, 15 tab, 23 ref, 1 append. 14-01-001-177.

Descriptors: *Desalination processes, *Hydrate processes, Hydrates, Hydration, Crystals, Crystal growth, Equilibrium, Aqueous solution, Saline water, Heat exchangers, Separation techniques, Water treatment, Water purification, Temperature, Thermal properties, Energy.

The results of research conducted on the properties of gas hydrates from July 1960 to June 30, 1961 are reported. The process of screening compounds as possible hydrate formers has been completed, and phase relations for methyl bromide, F-21, F-31, and F-142b were determined in the presence of pure water and aqueous NaCl solutions with concentrations up to 10% NaCl. The following information was calculated for each hydrate: heat of formation, composition of the solid hydrate, and the depression of the formation temperature due to NaCl and sea salts. Calculations of energy and heat exchanger requirements for the hydrate process with six different hydrating agents are summarized. The heats of formation of methyl bromide, F-21, and F-31 were revised. The relative merits of various hydrating agents are discussed. The most economical agent for use in the hydrate process has not yet been selected. (Davison-IPA)
W79-06277

DEVELOPMENT OF AN IMPROVED SOLAR STILL,
Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
W. N. Grune, R. A. Collins, R. B. Hughes, and T. L. Thompson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 144, Price codes: A07 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 60, March 1962. 127 p, 44 fig, 5 tab, 23 ref, 2 append. 14-01-001-178.

Descriptors: *Desalination, *Desalination processes, *Solar distillation, *Desalination apparatus, *Solar stills, Solar radiation, Design criteria, Efficiencies, Coolants, Equipment, Separation techniques, Water treatment, Water purification, Water yield, Treatment, Condensation, Evaporation.

Nine major still designs were studied in an effort to increase the fresh water yield from solar distillers. Natural convection designs, used as controls, also provided information regarding the transfer of vapor between the brine surface and cover. It was observed that the resistance to mass transfer increased with the difference in temperature between the brine and cover raised to the two-thirds power. The overall performance of the designs suffered when multiple glazings were used to increase the operating temperatures, because the increased reflection and insulation losses offset the increase in internal operating efficiency. In the forced convection design, air is blown through the still between the brine and cover into an external water cooled condenser. The deep basin design, equipped with a brine dispersion tray to increase the mass transfer area, was the most efficient of those investigated. It exhibited an optimum air flow rate of 6 cfm and operated at 50 to 60% efficiency. Because of high reflux losses and the reflection of solar radiation by droplets of condensate on nonwettable covers, shallow basin units without brine dispersion were less successful. Experimentation with recirculating the condenser coolant to increase production indicated that the increase was insufficient to justify the additional equipment involved. The most effective design studied was a multiple-depth forced convection unit which produced over two gallons/sq yd. (Davison-IPA)
W79-06278

INVESTIGATION AND PREPARATION OF POLYMER FILMS FOR SALINE WATER CONVERSION,
Monsanto Research Corp., Everett, MA. Boston Labs.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 297, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 61, April 1962. 56 p, 18 fig, 11 tab, 6 ref, 3 append. 14-01-001-203.

Descriptors: *Desalination, *Membranes, *Membrane processes, *Reverse osmosis, Mass transfer, Permeability, Desalination apparatus, Porosity, Physical properties, Chemical properties, Separation techniques, Water treatment, Water purification, Saline water, Cellulose acetate.

In an evaluation of currently (1960-61) available film formers for use in the desalination of sea water the effects of glycol additives on cellulose acetate I and II were studied. Casting techniques and pre- and post-conditioning methods were examined, and the suitable films were tested in a permeation assembly at varying temperatures under varying conditions of water separation. The experimental measurements were used to calculate the permeation coefficient, the efficiency of desalination, and the solubility coefficient. Of the other polymers tested as desalination membranes only polyvinyl alcohol showed potential. The other films were too brittle and ruptured when pressure was applied.

Two theories of the mechanism of water transmission were considered to explain the desalination of sea wate by the reverse osmosis process. The micropore theory states that water transmission through a polymeric film occurs by the passage of water molecules through the pores in the film which are too small to permit the passage of salt. In the second theory permeation takes place in three independent steps: (1) solution of the permeating molecules in the upstream face of the film; (2) diffusion of permeant molecules through the film matrix; and (3) evaporation of the permeant from the downstream face of the film. The successful use of low molecular weight hydrophilic materials as polymeric film modifiers supports the hydrogen bonding theory of transmission through the film. (Davison-IPA)
W79-06279

SEAWATER SOFTENING BY ION EXCHANGE AS A SALINE WATER CONVERSION PRE-TREATMENT,
Dow Chemical U. S. A., Freeport, TX. Texas Div.
W. F. McIlhenny.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 298, Price codes: A07 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 62, May 1962. 141 p, 49 fig, 30 tab, 19 ref, 4 append. 14-01-001-205.

Descriptors: *Desalination, *Pre-treatment(Water), *Water softening, *Cation exchange, *Resins, Water chemistry, Costs, Capital costs, Sea water, Evaporation, Alkalinity, Scaling, Equilibrium, Water treatment, Water purification, Separation techniques, Calcium compounds, Magnesium compounds.

The partial softening of sea water for use as a feed for desalination plants is discussed. The incoming sea water was softened by fluidized flow with a cation exchange resin, and the concentrated evaporation blowdown liquor was used as the sole regenerant for the ion exchange resin. Data on the method of softening, cycle times and flows, and softening efficiencies obtained are reported. Variable effects on softening efficiencies were studied. A large scale cost estimate based on pilot plant data is given. Four phases of evaporator operation were studied: (1) no sea water softening or alkalinity control; (2) soft sea water and no alkalinity control; (3) soft sea water with alkalinity control; and (4) a softened groundwater from Roswell, New Mexico. For each phase evaporator scaling rate, diesel usage, and distillate production were determined; scales were analyzed. The physical characteristics of the ion exchange resins as affected by plant operation were studied. Equilibrium data for the sea water-resin system are provided with a method for calculating the ternary ion system. It is concluded that sea water is sufficiently softened by cation exchange, preventing CaSO4 precipitation when the soft sea water is evaporated to four times normal sea water; the total concentration of the raw sea water had the most significant effect on the ability of the cation exchange resin to remove calcium. Capital costs for a 10,000,000 gpd plant producing a brine concentration of four times normal sea water are 1961 $1,610,000, with sea water softening costs at $.094/1000 gallons. (Davison-IPA)
W79-06280

ANNUAL REPORT (FY 1969), ROSWELL TEST FACILITY ROSWELL, NEW MEXICO,
Westinghouse Electric Corp., Orange, CA. Water Province Dept.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-201 014, Price codes: A06 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 529, February 1969. 101 p, 21 fig, 22 tab, 1 append. 14-01-0001-1808.

Descriptors: *Desalination, *Desalination plants, *Roswell Test Facility, Vapor compression distillation, Evaporation, Scaling, Descaling, Calcium compounds, Brackish water, Water treatment, Water purification, Separation techniques, Research and development, Roswell(New Mexico).

The double-effect forced-circulation evaporator plant at Roswell, New Mexico, has been expanded to include an evaporator as an auxiliary test unit, membrane pilot plants, a pilot scale feed water treatment system, and a laboratory. During the past year the operation policy was changed from a demonstration plant to a development and test facility. The seed slurry method was modified and was successful in demonstrating the prevention of scale formation. The test bed plant equipment was 'moth balled' until a study was completed to determine the feasibility of repairing the compressor or replacing it with the High Temperature Water Jet Compressor. The three phases of the Auxiliary Test Unit (ATU) calcium solubility investigations are discussed, and a schematic of this system is provided in the appendix. A silica removal system manufactured by the Johns-Manville Corporation and installed in the ATU system was successfully operated in two 100-hour evaluation runs. Replacement of its exchange media was necessary due to calcium carbonate and calcium sulfate fouling which occurred during operation on raw brackish feed water. When the feed was presoftened brackish water silica removal was 100%. Lay-up of the large plant which began in July 1968 was completed before March 1969. (Davison - IPA)
W79-06281

FINAL REPORT ON FOAM FRACTIONATION OF INORGANIC SOLUTIONS,
Horizons, Inc., Cleveland, OH.
J. J. Bikerman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-200 922, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 510, January 1970. 54 p, 4 fig, 65 tab. 14-01-0001-2118.

Descriptors: *Desalination, *Pre-treatment(Water), *Calcium, *Iron, *Manganese, *Brackish water, *Foam fractionation, Aqueous solutions, Foam separation, Metals, Surfactants, Treatment, Water purification, Water treatment, Desalination processes, Laboratory equipment, Sulfates, Water quality, Water quality control.

An investigation was undertaken to develop a method of pre-treating brackish water to facilitate the main desalination step involved in membrane processes. Calcium, iron and manganese were partially removed from the aqueous solutions of their salts by adding a foaming agent to the solution and bubbling air through it. The resulting foam contained a higher concentration of the metal than the initial residue or the residual solution. Greater concentrations of iron and manganese were found than for calcium in comparable conditions. The long-chain sulfates and poly (oxyethylene) sulfates showed the most potential of the many commercial foaming agents tested. The non-ionic surfactants were unsatisfactory. It was found that the accumulation ratio, i.e., the ratio of metal concentration in the foam to that in the initial solution, generally increases when the drainage time of the foam and the weight ratio 'surfactant:metal' increase. The accumulation ratio for the surfactant increases with the duration of drainage. The experimental results for the removal of calcium, iron and manganese are tabulated. (Davison - IPA)
W79-06282

KINETICS OF ICE NUCLEATION FROM WATER AND ELECTROLYTE SOLUTIONS,
Case Western Reserve Univ., Cleveland, OH.
G. R. Wood, and A. G. Walton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-200 913, Price codes: A09 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 500, November 1969. 180 p, 25 fig, 9 tab, 90 ref, 4 append.

Descriptors: *Desalination, *Desalination processes, *Freezing, *Electrolytes, Aqueous solutions, Ice-water interfaces, Nucleation, Drops, Crystal growth, Kinetics, Energy, Physical properties, Oil-water interfaces, Environmental influences, Water treatment, Water purification, Separation techniques.

The homogeneous nucleation of ice was experimentally characterized and the applicability of nucleation theory was tested. Nucleation rates for the formation of ice from electrolyte solutions and water were calculated from observations of the frequency with which liquid droplets solidify. The stochastic nature of droplet freezings was considered and statistical methods were used for weighing observations and predicting experimental errors. Methods were found for incorporating the solidification dependencies in the rate calculations. The environmental influence on the water droplets, tested by varying the emulsion oils, droplet substrates and water purity, were found to be ineffective. Isothermal and continuous cooling experiments yielded nucleation rates which were in good agreement with each other; their temperature dependence was in accord with the functional relationship predicted by theory. The rate's temperature dependence indicated a transition to a homogeneous nucleation mechanism. Decreasing water activity and an increasing ice-solution interfacial energy were related to the increase in the isokinetic supercoolings for sodium chloride solutions. The surface energies and their temperature dependence indicate that the presence of an electrolyte disrupts the orientation of water molecules at the ice surface. It was not possible to differentiate the dependence of this effect on the specific nature of alkali halide electrolytes from experimental uncertainties. (Davison-IPA)
W79-06283

SECONDARY NUCLEATION OF ICE IN A SUSPENSION OF CRYSTALS IN TURBULENT CYLINDRICAL COUETTE FLOW,
Clarkson Coll. of Technology, Potsdam, NY.
J. Estrin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-200 907, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 494, January 1970. 77 p, 22 fig, 6 tab, 54 ref, 3 append. 14-01-0001-971

Descriptors: *Desalination, *Freezing, *Desalination apparatus, *Couette flow apparatus, *Nucleation, *Ice-brine systems, Boundaries(Surface), Crystallization, Crystal growth, Separation techniques, Water treatment, Saline water, Water purification, Water quality.

The use of a cylindrical Couette flow apparatus in an experimental investigation into the secondary nucleation characteristics of ice-brine slurries is discussed. This apparatus was selected because of its agitation characteristics and its large heat transfer surface to active volume ratio; it consists of two, vertical, concentric cylinders with the slurry of crystals contained in the annulus between them. The unit was employed with the ice-brine system to generate ice crystals with continuous and batch methods of operation. Stable deposition of ice upon the cooling surfaces, the major operational problem, was more severe in continuous operation experiments than in batch experiments. The combination of continuous and batch crystallization experiments is suggested as potentially providing the most meaningful results in the secondary nucleation process. The level of agitation appears to be an important variable determining nucleation kinetics. It is concluded that the Couette flow apparatus is a useful means for investigating the secondary nucleation characteristics of ice-brine slurries. (Davison-IPA)
W79-06284

DIFFUSION IN TERNARY AQUEOUS SALINE SOLUTIONS,
Loyola Univ., New Orleans, LA.
R. P. Wendt, and M. Shamim.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-200 917, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report

No. 504, December 1969. 72 p, 7 fig, 16 tab, 31 ref, 5 append. 14-01-0001-1303.

Descriptors: *Aqueous solutions, *Saline solutions, *Diffusion, *Saline water systems, *Electrolytes, Ions, Magnesium compounds, Sodium compounds, Sea water, Computer programs, Laboratory equipment, Desalination, Water analysis, Water chemistry.

An investigation of the electrolytic ternary system H20-MgC12-NaCl, containing divalent ions, was undertaken to help technologists working with systems similar to sea water. Various diffusion theories in ternary systems and theories for predicting diffusion coefficients are discussed. The experimental and theoretical procedures described include: preparation of solutions, cell calibration, and methodology. Physical methods of solution analysis were selected. It was found that to obtain maximum accuracy in determining some coefficients the solutions should be analyzed chemically or physically for each solute; this would involve a great number of lengthy analyses. The rotating diaphragm diffusion cell developed for the experimental work required no maintenance or recalibration. The solution concentrate it uses must be slightly greater than C=0.05M to avoid solute-porous glass disc interactions. This cell cannot be used with nonaqueous systems. In this study the large cross-term coefficients D12 and D21 measured for each of the H20-MgC12-NaCl systems indicated that errors may be introduced by assuming electrolyte solutes in multicomponent systems diffuse independently according to Fick's law. Computer printouts of the programs for calculating diffusion coefficients and activity coefficient derivatives are provided in the appendices. (Davison-IPA)
W79-06285

FEASIBILITY, RESEARCH AND ANALYSIS OF HEAT EXCHANGE SYSTEMS WITHOUT HEAT EXCHANGE SURFACES: LABORATORY STUDY OF SINGLE STAGE VAPOR REHEAT DISTILLATION,
FMC Corporation, Santa Clara, CA. FMC Machinery/Systems Group.
W. S. Thompson, T. Woodward, W. A. Shrode, E. D. Baird, and D. A. Oliver.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 299, Price codes: A13 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 63, April 1962. 272 p, 41 fig, 25 tab, 28 ref, 2 append. 14-01-001-163, -173-217.

Descriptors: *Desalination, Desalination apparatus, *Heat exchangers, *Distillation, Heat transfer, Organic compounds, Solubility, Drops(Fluid), Particle size, Flash distillation, Separation techniques, Water treatment, Water purification, Sea water.

The research is presented in two parts. In Phase One of Part A, the literature was reviewed with regard to free rise or fall of liquid drops in water, flooding velocities in spray columns, and heat transfer coefficients in spray columns. Of the three potential heat exchange liquids studied and tested, hydrocarbons of high molecular weight appeared most suitable as heat-exchange media. Calculations were made to determine the approximate size of equipment required for a 10,000,000 gpd sea water distillation plant. In Phase Two of Part A certain properties of hydrocarbons were discussed regarding shell fluids. Each of the following specific subject areas are treated independently: (1) the solubility of hydrocarbons in water and the solubility of water in hydrocarbons; (2) the effect of variable specific heat on the performance of a heat exchanger; and (3) the rate of rise of hydrocarbon drops in water and the effect of drop size on the dimensions of the heat exchanger. In Part B the construction and operation of experimental heat exchangers is discussed. The data obtained indicates that heat transfer is approximately a linear function of oil fluidity for top hot operation. Other variables affecting heat transfer include flow rate and direction of heat flow. It was found that heat transfer is practically independent of orifice diameter. (Davison-IPA)
W79-06286

DETERMINATION OF THE PRACTICALITY OF THE OSMIONIC PROCESS,
Southern Research Inst., Birmingham, AL.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 345, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 64, August 1962. 96 p, 25 fig, 11 tab, 4 append. 14-01-001-193.

Descriptors: *Desalination, *Desalination processes, *Osmionic process, *Demineralization, *Economic feasibility, *Project feasibility, Resistance, Membrane processes, Separation techniques, Water treatment, Water purity, Water purification, Costs, Estimated costs, Laboratory tests, Laboratory equipment.

An eight cell bench-scale osmionic demineralizer was developed in which the demineralization performance closely approached theoretical predictions. The final design, evaluated experimentally in short term runs, gave trouble-free operation during two weeks of intermittant operation. It is believed that changes in the physical design would not effect major improvements in demineralization performance. Experimental work validated the corrected theoretical expressions describing demineralization performance. It was found that the usual methods for measuring membrane resistance gave values that may not be representative of the actual resistance occurring during demineralization. A study was made to determine which methods of measuring resistance and transference in membranes would give values representing their actual occurrence during demineralization. Cost estimates show that demineralization by the osmionic process would be two to three times as much demineralization by electro-dialysis. (Davison-IPA)
W79-06287

INVESTIGATION OF THE USE OF ACOUSTIC VIBRATIONS TO IMPROVE HEAT TRANSFER RATES AND REDUCE SCALING IN DISTILLATION UNITS USED FOR SALINE WATER CONVERSION.
Southwest Research Inst., San Antonio, TX.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 346, Price codes: A08 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 65, August 1962. 158 p, 43 fig, 29 tab, 8 ref. 14-01-001-188.

Descriptors: *Desalination, *Heat transfer, *Boiling, *Vibrations, *Acoustics, *Reynolds number, Flow, Water analysis, Separation techniques, Water treatment, Desalination apparatus, Condensation, Steam, Resonance, Standing waves.

A boiling heat transfer study was undertaken to define the magnitude of heat transfer improvement and the limits of heat flux over which vibration of the heat transfer surface might improve nucleate boiling coefficients. The effect of vibration on heat transfer from the inner tube to water in forced axial flow through an annulus was investigated at Reynolds numbers of 5,000 to 28,000. Increased heat transfer rates were produced by transverse vibration of the inner tube, and improvement with annulus ratios was greater at low flow Reynolds numbers. However, the economic advantage increased with increasing Reynolds numbers. The use of resonant acoustic vibrations in water was studied. Considerably less improvement in forced convection heat transfer was produced than for vibration of the heat transfer surface. Increases in steam condensation rates up to 122% were observed in the study of the effect of vibration of the heat transfer surface on steam condensation. Vibration on nucleate boiling transfer was investigated over heat flux ranges of 2,300-15,200 and 50,000-250,000 Btu/hr-sq ft. Boiling heat transfer coefficients increased as high as 133% at a heat flux of 4,000 Btu/hr-sq ft with inner tube variation at its resonant frequency of 38 cps and an amplitude of 0.35 sec. It is concluded that the use of vibration of the heat transfer surface to improve heat transfer in desalination has potential economic advantage. (Davison-IPA)
W79-06288

DIFFUSION STILL ANALYSIS,
General Electric Co., Burlington, VT. Advanced Science and Technology Lab.
P. Kroeger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 672, Price codes: A13 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 99, April 1964. 283 p, 93 fig, 55 tab, 25 ref. 14-01-0001-314.

Descriptors: *Desalination, *Desalination appratus, *Diffusion still, Evaluation, Feasibility, Heat transfer, Mass transfer, Computer programs, Equations, Separation techniques, Water treatment, Water purification, Laboratory tests, Laboratory equipment, Saline water, Scaling, Corrosion.

Experimental and analytical work was undertaken to determine the feasibility and performance capability of the diffusion still process. Single-stage and multi-stage performance models were developed to study the heat and mass transfer mechanism and to permit performance predictions beyond the range of the available test equipment. A system of equations describing the heat and mass transfer in a single-stage unit was developed, and solved in a computer program. In comparing the computed single-stage results with test data from the literature good agreement was found for reservoir-condenser temperature differences below 35F. The multi-stage system was treated as a series of single stages. The system of equations developed for describing a multi-stage diffusion still was also solved in a computer program, and the results were in satisfactory agreement with test data from the literature. The influence of various design and process parameters for both the single- and multi-stage performances were studied. The losses occurring in the multi-stage unit during testing were inherent in the design of the unit rather than the diffusion still process itself. The main loss was by direct evaporation of incoming reservoir water and condensation of this water within the condenser. An inspection after saline water tests revealed no scale formation occurred, but the use of the combination of a copper condenser and aluminum disks resulted in some aluminum corrosion. (Davison-IPA)
W79-06289

HIGH-TEMPERATURE TRANSFERENCE NUMBERS IN PURE AND MIXED AQUEOUS ELECTROLYTES,
Southern Research Inst. Birmingham, AL.
E. B. Dismukes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 581, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 87, March 1964. 38 p, 9 fig. 14-01-0001-254.

Descriptors: *Electrolytes, *Aqueous solutions, *Moving boundary method, Electrochemistry, Anions, Cations, Water properties, Desalination, Desalination processes, Laboratory tests, Temperature separation techniques, Water treatment, Water purification.

A research program was undertaken to obtain fundamental information on the properties of aqueous electrolytes by measuring and interpreting transference number data under conditions where a paucity of data exists. Electrolytes containing sodium and magnesium cations and chloride and sulfate anions were studied. Transference measurements were made with the moving boundary method, and an electrometric technique was used to determine displacement rates. The results of the procedures were unsatisfactory in reproducibility. The range in results from duplicate experiments frequently differed from the desired accuracy of approximately 0.05% by 0.2% or more. The precision of data obtained from experiments with transference in NaCl solutions showed the effect of temperature variations at temperatures up to 125C. In other experiments the precision was unaccepta-

ble. It is thought that variations in the diffuseness of the moving boundary may be responsible for the poor reproducibility in transference data. (Davison-IPA)
W79-06290

SECOND ANNUAL REPORT, SALINE WATER DEMONSTRATION PLANT NO. 1, FREEPORT, TEXAS,
Stearns-Roger Corp., Denver, CO.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 681, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 100, March 1964. 92 p. 20 fig, 5 tab. 14-01-001-218.

Descriptors: *Desalination, *Desalination plants, *Desalination processes, *Long-tube vertical multiple effect evaporation, Demonstration Plant No. 1, Freeport(Texas), Equipment, Materials, Analysis, Sea water, Water treatment, Water purification, Separation techniques, Evaporation, Scaling, Water yield, Research and development, Water costs.

Technical, economic, and logistical evaluations of the Long-Tube Vertical (LTV) multiple evaporation method of desalination employed by Demonstration Plant No. 1, Freeport, Texas, are reported for the period July 1, 1962 to June 30, 1963. Results of a microbiological survey indicated no corrosion and only very minor problems in other areas. An intensive deaerator performance investigation shows that 2000 lbs/hr of steam are required for maximum carbon dioxide and oxygen removal. The maximum production of the plant was determined to be 1,200,000 gpd. The factors limiting the equipment at this capacity were P-17 brine pump and maximum temperature (without scaling) to the first effect evaporator. No definite conclusions have been formulated from data compiled to determine the operating efficiency of the heat exchangers and the evaporators. Despite a 93 and one-half day shut down for maintenance total annual production and cost figures compare favorably with those of the previous year. Total production for the period was 250,183,830 gallons, and average total unit gross cost/1000 gallons was $1.68. The major technical facets, process, equipment, and materials analyses were evaluated based upon the experimental and operational data compiled during the period. (Davison-IPA)
W79-06291

RESEARCH AND DEVELOPMENT ON REVERSE OSMOSIS MEMBRANE MODULES,
General Atomic Co., San Diego, CA.
V. Merten.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-177 204, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 165, January 1966. 62 p, 21 fig, 6 tab, 2 append. 14-01-0001-426.

Descriptors: *Desalination, *Desalination processes, *Reverse osmosis, Membranes, Materials testing, Fabrication, Operations, Strength of materials, Compressive strength, Plastics, Separation techniques, Water treatment, Water purification.

Work on the spiral-wound reverse osmosis membrane module is reported from the time of its conception to July 1, 1965. Emphasis during the past year was (1) on finding suitable product water side backing materials which would support the membrane and at the same time allow the product water to be removed, and (2) on the fabrication method of the modules. Compression strength requirements and pressure drop were considered in selecting the product water side and brine side spacer design. The most promising materials selected include plastic materials for the brine side spacer in all systems and for the product water side space in low-pressure systems; and or glass bead materials were selected for the product water side spacer in high pressure systems. Two types of modules are being fabricated. The first type utilizing plastic backing material suitable for long-term use at pressures up to 200 psi, has been tested extensively and is considered reliable for use in commercial systems. The second type utilizes glass beads as the backing material and is suitable for system pressures of 1500 psi and above. The modules performed well as complete units at pressures up to 400 psi. Module performance test data are presented and the test loop is described. (Davison-IPA)
W79-06292

DECONTAMINATION OF WATER CONTAINING CHEMICAL AND RADIOLOGICAL WARFARE AGENTS BY REVERSE OSMOSIS,
Army Mobility Equipment Research and Development Command, Fort Belvoir, Va. Energy and Water Resources Lab.
For primary bibliographic entry see Field 5D.
W79-06340

THE INFLUENCING OF HIGH MOLECULAR WEIGHT ADDITIVES ON THE FLASHING PROCESS (A SCREENING STUDY),
Houston Research Inc., TX.
A. E. Dukler, and R. F. Castle.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-200 926, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 515, April 1967. 25 p, 10 fig, 1 tab. 14-01-0001-530.

Descriptors: *Desalination, *Desalination processes, *Multi-stage flash distillation, *Additives, *Polymers, Organic compounds, Plastics, Chemicals, Drag, Resistance, Weight, Equipment, Laboratory tests, Mass transfer, Equilibrium, Separation techniques, Water treatment, Water purification.

Three high molecular weight polyethylene oxide polymers were mixed with distilled water to form an additive solution in an evaluation of their significance in drag reduction in flash systems. The experimental equipment consisted of a Plexiglas single stage flash chamber with a liquid holding chamber, rectangular underflow orifice, a flash liquid splash plate, and a liquid baffle; other equipment consisted of a steam jet vacuum system, reservoir and pump. During the 14 test runs the additive rate was measured by volume change in the feed tank. The test runs were made with different additives at different rates, and with different conditions of vacuum, temperature, and flashing of liquid. Although the amount of drag reduction was not significant with these additives, they did cause more uniform bubble distribution downstream of the orifice. This is expected to cause improved mass transfer in the flash chamber, more rapid approach to equilibrium, and shorter metastable periods. (Davison-IPA)
W79-06424

STUDY AND FIELD EVALUATION OF SOLAR SEA-WATER STILLS,
Battelle Memorial Inst., Columbus, OH.
J. W. Bloemer, R. A. Collins, and J. A. Eibling.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-171 934, Price codes: A07 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 50, September 1961. 123 p, 101 fig, 7 tab, 2 ref, 4 append. 14-01-001-108.

Descriptors: *Desalination, *Solar distillation, *Distillation, *Evaporation, *Solar stills, Equipment, Desalination apparatus, Research and development, Solar radiation, Plastics, Water yield, Heat loss, Design criteria, Construction costs, Energy balance, Solar distillation research station, Florida, Water treatment, Separation techniques.

Research conducted from January 20, 1958 to January 31, 1960 on direct solar distillation is reported. In this process saline water is evaporated from a basin or wick through solar radiation, and the vapor is condensed on some lower temperature surface of the still. A solar distillation research station was established in Northern Florida, where three basin-type solar stills were constructed and evaluated. Life tests of various plastic films were started during the research period. The research station and the stills are described. Performance data obtained during still operation is presented in detail. Results of these performance tests show that the productivity of the basin-type stills was nearly entirely dependent upon the intensity of the solar radiation, and it was not affected appreciably by weather conditions. Two Du Pont air-supported plastic stills of 500 and 2300 sq ft were also constructed; they were operated for about a year. It was found that there was very little difference in the performance of either type of still when both were in good operating condition. The greatest single heat loss in the basin still is radiation from the basin water to the cover. An improved design for the deep-basin still using an asphalt base, concrete support beams and a glass cover would reduce construction costs and increase its life. (Davison-IPA)
W79-06426

EXPANDED GLASSY POLYMERS AND POLYELECTROLYTE COMPLEXES AS REVERSE OSMOSIS AND ION-SELECTIVE MEMBRANES,
Massachusetts Inst., of Tech., Cambridge.
R. F. Baddour, W. R. Vieth, A. S. Douglas, and A. S. Hoffman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-191 232, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 274, October 1967. 81 p, 30 fig, 4 tab, 27 ref, 2 append.

Descriptors: *Desalination, *Membranes, *Fabrication, *Materials, *Polymers, *Evaluation, *Materials testing, *Plastics, Reverse osmosis, Thin films, Technology, Permeability, Desalination apparatus, Electrolytes.

The development of methods for synthesizing new hydrophilic membrane materials such as, polyelectrolyte complexes, polyurethanes, and hydroxyethyl methacrylate (HEMA) membrane systems is discussed. The research goal was to develop new materials with higher water permeabilities and longer useable lifetimes than cellulose acetate (CA), while keeping the salt rejection capacities of CA. In an effort to improve the performance of cellulose nitrate and other existing membranes modifications were made in the template inclusion technique with and without selective post-annealing. The experimental procedure involved the preparation and evaluation of hyperfiltration systems; characterization techniques are discussed. Experimental results show that the permeability of a film to dissolved salts can be controlled by varying the membrane preparation conditions. Reduction of the salt permeability usually coincides with reduction of water flux through the membrane. Cellulose nitrate and HEMA showed salt rejections of 90% at low rates, with polyurethanes having only a slightly lower value. New techniques were developed to control the water flux and salt rejections for these three materials; technology to control the properties of a number of hydrophilic polymers is now available. Polyurethanes and HEMA, prepared as ultrathin films, are the most promising materials for use in reverse osmosis. (Davison-IPA)
W79-06427

THE POTENTIAL CONTRIBUTION OF DESALTING TO FUTURE WATER SUPPLY IN NEW MEXICO,
Southwest Research Inst., San Antonio, TX.
D. E. Morris, and W. L. Prehn, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-208 787, Price codes: A08 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 767, Int-OSW-RDPR-71-767, September 1971. 174 p, 29 fig, 100 tab, 79 ref, 7 append. 14-01-0001-2580.

Descriptors: *Desalination, *Desalination processes, *Water supply, *Water treatment, *Cities, *Feasibility, *Economics, *Desalination plants,

Distillation, Electrodialysis, Flash distillation, Freezing, Reverse osmosis, Vapor compression distillation, Longtube vertical distillation, Water quality, Water quality control, Desalination wastes, New Mexico.

In a statewide study of the technical and economic feasibility of desalting the five New Mexico communities, Artesia, Gallup, Moriarity, Tularosa, and Zuni Pueblo, were selected on the basis of deteriorating water quality in their present water supplies. All local conditions, topography, climate, water demand, sewage production, and existing plant, were considered in determining whether or not desalting could improve water quality under acceptable economic conditions. The various desalting processes were calculated with regard to the individual community characteristics, and the most applicable process was selected for each. Calculations were made for electrodialysis, reverse osmosis, vapor compression-vertical tube evaporator-multistage flash distillation, vacuum-freezing vapor compression, and ion exchange in several combinations. Complete system costs are reported on the basis of product water which includes feedwater production, the plant and appropriate pretreatment, brine disposal, and pipelines. The final product water quality parameters include: 500 ppm TDS maximum; 250 ppm sulfates maximum; and 100 ppm CaCO3 hardness maximum. It was assumed that part of the brine from the desalt plant would be mixed with the effluent discharged from existing sewage treatment plants. All criteria were used only for developing the costs which are presented. (Davison-IPA)
W79-06428

NEW AND IMPROVED METHODS FOR LOWER COST SOLAR DISTILLATION,
New York Univ., NY. Coll. of Engineering.
M. Telkes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 402, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 31, August 1959. 40 p, 12 fig, 3 ref. 14-01-001-68.

Descriptors: *Desalination, *Desalination processes, *Desalination apparatus, *Solar stills, Design criteria, Equipment, Construction materials, Feeding rates, Flow, Flow rates, Condensation, Distillation, Heat exchangers, Heat flow, Solar radiation, Solar distillation, Separation techniques, Water treatment, Water purification.

Continued work in the design of and experimentation with flat, tilted single effect and multiple effect solar stills is reported. Improvements in single effect solar stills were obtained by using the heat carried away in the overflow brine and regulating the flow rate of the feed water. Attempts to reuse the heat of condensation failed to increase the distillate yield. A 10 to 15% increase in water yield on sunny days resulted from the use of a heat exchanger tube to recover the heat carried away by the outflowing brine; larger increases occurred on cloudy or partly cloudy days. The use of solar radiation to operate a capillary flow rate governor led to automatic regulation at the feed water. It was found that an increase in temperature changes the fluidity of the feed water, and thus the feeding rate increases in proportion to solar radiation intensity. Electrical heating was used during the sunless colder months in tests of new large multiple effect stills. The results obtained with the use of aluminum sheets were comparable to those previously obtained with Mylar films. This new still was constructed with 7.9 sq ft evaporating plates. The construction and materials of construction for both types of stills are discussed, and diagrams of the stills are provided. (Davison-IPA)
W79-06429

AVAILABILITY OF GEOTHERMAL ENERGY FOR THE DEMINERALIZATION OF SALINE WATER,
Battelle Memorial Inst., Columbus, OH.
J. C. Bell, R. C. Crooks, W. T. Holser, G. F. Sachsel, and J. R. Williams.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 400, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 27, July 1959. 62 p, 5 fig, 17 tab, 51 ref, 5 append. 14-01-001-89.

Descriptors: *Desalination, *Geothermal studies, *Demineralization, *Estimated costs, Engineers estimates, Thermal conductivity, Thermal properties, Heat flow, Thermodynamics, Equilibrium, Electric power production, Evaporation, Separation techniques, Water treatment, Water purification, Saline water.

A literature survey, a theoretical analysis of heat flow into different hole configurations in the earth, and an engineering appraisal of the utilization of geothermal energy were used to evaluate the potential use of geothermal energy for the demineralization of saline water. The selected 'best' determinations of equilibrium heat flow in various regions, estimates of equilibrium heat flow, temperature gradients, and thermal conductivities of rocks, all determined from the literature, are tabulated. The geological factors contributing to increased heat flow in the earth include recent igneous activity, regional increases in radioactivity of the earth's crust, presence of mountain roots, and simultaneous uplift and erosion. Four basic hole configurations were studied: (1) a plane, (2) a sphere, (3) a horizontal hole, and (4) a vertical hole. The literature provided mathematical solutions for the first three, and an original solution for the vertical hole was derived in this study. A water loop which conveyed heat from the source to an expansion turbine for electric power generation or a multiple-effect evaporator comprised the system considered. Cost estimates for a salt water evaporation plant using geothermal energy with an average thermal gradient in a 20,000 ft vertical shaft in granite, 1 ft in diameter, were over $28/1000 gallons of fresh water. The cost of the hole represented about 75% of the total estimated investment. (Davison-IPA)
W79-06430

PRODUCING PERMANENTLY HYDROPHYLIC SURFACES ON PLASTIC FILMS FOR SOLAR STILLS,
Franklin Research Center, Philadelphia, PA.
R. A. Erb.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 064, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 29, September 1959. 30 p, 4 fig, 2 tab. 14-01-001-168.

Descriptors: *Solar stills, *Films, *Coatings, *Plastics, *Titanium, Testing, Evaluation, Condensation, Surfaces, Silicon, Wettability, Hydrolysis, Submergence, Research and development, Water treatment, Desalination, Desalination processes, Desalination apparatus, Separation techniques.

Two approaches were investigated in the effort to produce a permanent transplant hydrophilic surface on a variety of plastic films for solar still condensing surfaces. The first method involved the vacuum deposition of silicon monoxide on the surfaces; the second involved the chemical deposition of titanium dioxide on the surface by means of the hydrolysis of tetraalkyl orthortitanates. Both methods proved to be technically feasible, but due to its lower cost and its ready adaptability to large scale operation, titanium dioxide was the process of choice. In a study of the parameters of the titanium dioxide process with optimum alkyl titanate, solvent, relative humidity, and other variables were determined. The immersion durability of titanium dioxide coated polymers was studied, and after seven months immersion in distilled water no coating failure was apparent. A continuous dip-coating technique was performed satisfactorily on cellulose acetate 9.5 in wide and 100 ft long, and a large test was made on weatherable Mylar, 54 in wide. Cloudy areas formed because of high humidity. (Davison-IPA)
W79-06431

BIBLIOGRAPHY OF MEMBRANE TECHNOLOGY PERTAINING TO SALINE WATER DESALINATION.
Office of Water Research and Technology, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 554, Price codes: A06 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 83, October 1963. Compiled by G. F. Mangan, Jr., J. M. Shackleford, and K. A. Kase, 121 p.

Descriptors: *Bibliographies, *Publications, *Membranes, *Membrane processes, *Desalination, *Patents, Saline water, Technology, Research and development, Design, Ions, Hydration, Physicochemical properties, Desalination apparatus, Thermodynamics, Mass transfer, Ion transport, Films, Permselective membranes, Semipermeable membranes, Resins, Water purification, Separation techniques, Water treatment.

A chronological listing of published literature references on membrane technology in the desalination of saline water is presented for the years 1908 through 1963; the listings for each year appear alphabetically according to author. The patent bibliography contains patent listings for the U.S., Great Britain, Japan, Austria, Canada, The Netherlands, Germany, East Germany, France, India, Israel, Italy, Poland, Switzerland, and the U.S.S.R. (Davison-IPA)
W79-06432

CONVERSION OF SALINE WATER: A BIBLIOGRAPHY OF LITERATURE RESULTING FROM THE ACTIVITIES SPONSORED BY THE OFFICE OF SALINE WATER.
Office of Water Research and Technology, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 546, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Report No 82, October 1963. Compiled by K. A. Kase, 63 p.

Descriptors: *Saline water, *Bibliographies, *Publications, Desalination, Demineralization, Distillation, Solar distillation, Electrodialysis, Freezing, Flash distillation, Hydrate processes, Ion exchange, Ion transport, Long-tube vertical distillation, Membrane processes, Osmosis, Reverse osmosis, Desalination apparatus, Desalination plants, Water treatment, Separation techniques, Water purification.

Monographs, scientific and technical reports, papers, and periodical articles resulting from the activities of the Office of Saline water, or written by a staff member of that Office are listed alphabetically by author. Articles and monographs are listed in Part I; Research and Development Progress Reports, in Part II. Of the eight appendices, five contain listings for papers presented at symposia, one contains a listing of papers presented at a conference, and the remaining two contain an author index and a subject index. (Davison-IPA)
W79-06433

CONCENTRATION POLARIZATION IN REVERSE OSMOSIS DESALINATION WITH VARIABLE FLUX AND INCOMPLETE SALT REJECTION,
Massachusetts Inst. of Tech., Cambridge.
P. L. T. Brian.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-179 436, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 145, September 1965. 41 p, 7 fig, 4 ref, 1 append. 14-01-0001-295.

Descriptors: *Desalination, *Desalination processes, *Reverse osmosis, *Membrane processes, Equations, Computer programs, Permeability, Water treatment, Water analysis, Separation techniques, Water purification, Research and development.

The concentration polarization in a saline solution flowing in a two-dimensional channel between flat

parallel osmotic membranes is analyzed. A Fortran program is developed to solve the finite-difference equations derived from theoretical analysis. The permeation flux falling off as the salt builds up at the membrane surface and the effect of incomplete salt rejection are examined. The results indicate that comparison of these solutions with the solutions for a constant flux membrane operating at the same average permeation flux show that the concentration polarization is greater for the variable flux case near the channel entrance, and is lower near the channel exit. A simple design procedure is formed in which the constant flux solution can be used to predict the effects of concentration polarization on the required pressure drop and on the product water salinity for a variable flux membranes. (Davison-IPA)
W79-06434

THE MECHANISM OF DESALINATION BY REVERSE OSMOSIS,

Aerojet - General Corp., Azusa, CA.
B. Keilin.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-166 395, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 117, 1964. 86 p, 17 fig, 22 tab, 22 ref. 14-01-0001-338.

Descriptors: *Desalination, *Desalination processes, *Reverse osmosis, *Membrane processes, Membranes, Physical properties, Chemical properties, Fabrication, Mass transport, Bound water, Thin films, Plastics, Heat treatment, Moisture content, Research and development, Permeability, Permeable membranes, Permselective membranes, Hydration, Ions, Additives, Separation techniques, Water treatment.

Certain aspects of the swelling of secondary cellulose acetate by membrane salts have been clarified in continuing research on the mechanism (s) of material transport across a reverse osmosis membrane. The completed membrane salt studies have yielded new data regarding various membrane fabrication parameters. The depth of the active layer has been redetermined by gradual hydrolysis of the active layer to a non-salt-retaining cellulose structure. The water contents of thin films, determined gravimetrically, prove that these films are less highly swollen than the bulk membranes. The bound water content of desalination membranes before and after heat and pressurization treatments very in a similar manner to that of the total water content. That permeabilities of many inorganic salts vary inversely with the extent of hydration of the component ions has been interpreted in terms of the bound water requirement for solution of the various ions in the membrane. It was found that the permeabilities of many sterically similar compounds with different functional groups vary with the hydrogen-bonding capacities of the solute species. Salt-retention capacity of the desalination membrane was improved by the addition of small amounts of additives to the feed solution. Feed additive effectiveness appears to be related to the surfactant capacity of the solute species. After investigation it was determined that microbial decomposition was responsible for the decrease in membrane desalination properties occurring upon storage in saline solution, rather than hydrolysis due to the brine. (Davison-IPA)
W79-06435

SALT CONCENTRATION AT THE SURFACE OF TUBULAR REVERSE OSMOSIS MEMBRANES,

Massachusetts Inst. of Tech., Cambridge.
R. E. Fisher, T. K. Sherwood, and P. L. T. Brian.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-177 203, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 141, September 1965. 38 p, 7 fig, 3 tab, 9 ref. 14-01-0001-295.

Descriptors: *Desalination, *Desalination apparatus, *Membranes, *Salt build-up, *Reverse osmosis, *Membrane processes, Permselective membranes, Semipermeable membranes, Equations, Digital computers, Diffusion, Velocity, Flow, Separation techniques, Water treatment, Water purification.

In a preliminary analysis of salt build-up, the saline solution was assumed to contain a single salt with a diffusion coefficient independent of salt concentration. The system considered was assumed to be isothermal, the water flux was assumed constant over the entire surface of the cylindrical membrane, and free convection was neglected. The velocity field equations are combined with the salt diffusion equations to express the salt concentration field as a function of the tube diameter, tube length, axial saline water flow velocity and water flux through the membrane. The equations were solved in two phases with a digital computer. Phase I generated the eigenvalues; Phase II generated the radial eigenfunctions, the series constants, and the concentration field from the eigenvalues. It was found that the effect of the salt build-up on the water flux depends on the operating conditions, and to keep less than a two-fold build-up of the salt concentration at the membrane surface over the initial feed concentration, very small diameter tubes, very short channel lengths, or multiple pass operations are required at higher water fluxes. (Davison-IPA)
W79-06436

REVERSE OSMOSIS FOR WATER DESALINATION,

General Atomic Co., San Diego, CA.
H. K. Lonsdale, U. Merten, R. L. Riley, K. D. Vos, and J. C. Westmoreland.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 696, Price codes: A07 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 111, May 22, 1964. 149 p, 49 fig, 17 tab, 96 ref. 14-01-0001-250.

Descriptors: *Desalination, *Desalination processes, *Reverse osmosis, *Membranes, *Fabrication, Laboratory testing, Materials testing, Plastics, Physical properties, Estimated costs, Water costs, Desalination plants, Desalination apparatus, Separation techniques, Water treatment, Water purification, Sea water, Brackish water, Boundary layers, Mass transfer.

The properties of semipermeable membranes were studied and phenomenological descriptions were derived of flow through such membranes and the liquid phases in contact with them. Preliminary considerations of some of the engineering problems related to the reverse osmosis process, and an initial attempt at developing optimization techniques for reverse osmosis plant design are also included. Experimental work on the boundary-layer effects in reverse osmosis, transport properties of cellulose acetate (CA) membranes, polyvinyl alcohol (PVA) membranes, the transport properties of cellophane and other alternative membrane materials is discussed. Results of experimental work to determine lifetime properties of cellulose acetate membranes indicate that these membranes, as they are now prepared, can be expected to have a life of several months in brackish waters, but their useful lifetime in concentrated sea water may be shorter. The theoretical treatment of boundary-layer effects gave a reasonable representation of the experimental data obtained with CA membranes. The results of an economic study made of the energy requirements and capital costs of proposed sea water conversion systems using reverse osmosis show that 30 to 50% of the cost of product water is accounted for by capitalization charges on the membrane separator. The estimated product water cost figure of $1.00/1000 gallons indicates that the development of more efficient membranes is not a prerequisite to the establishment of reverse osmosis as a desalination process competitive with existing systems. (Davison-IPA)
W79-06437

CHAMBER GEOMETRY IN MULTI-STAGE FLASH EVAPORATORS.

Weir Westgarth Ltd., London (England).

Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 682, Price codes: A06 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 108, July 1964. 91 p, 34 fig, 3 tab, 4 ref, 5 append. 14-01-0001-262.

Descriptors: *Desalination, *Desalination processes, *Desalination apparatus, *Flash distillation, Design data, Specifications, Equations, Volume, Shape, Temperature, Separation techniques, Water treatment, Water purification, Sea water, Reynolds number.

The importance of various parameters on the length of a typical stage in a multi-stage flash evaporator for sea water conversion was studied on a simulated flash chamber with an adjustable wall. Using a set of standard conditions chamber efficiency was found at different chamber lengths, and an optimum length for complete vaporization was established. Data obtained from the examination of each parameter over a range of variables were expressed in the form of efficiency curves vs chamber length; constant efficiency curves were plotted for a given parameter. An empirical equation, derived from the test data for a specified range of conditions, enables an estimate to be made of the minimum chamber length required for complete flash-off. Of all the variables studied, the brine flow had the greatest effect on the chamber length. It is concluded that: if flash chamber length is reduced for constant flashing conditions, the chamber efficiency remains constant at 100% until a critical point is reached; further length reductions result in a rapid drop in efficiency for small decreases in length; chamber length is directly proportional to stage temperature drop; the chamber length - temperature characteristic is a function of specific volume, inversely proportional to temperature; and the geometry of the interstage brine transfer and splash plate arrangement is of great importance when designing a flash chamber. (Davison-IPA)
W79-06438

FURTHER PROPERTIES OF HYDRATES AND HYDRATING AGENTS,

Syracuse Univ. Research Inst., NY.
A. J. Barduhn, N. Klausutis, R. W. Collette, and J. R. Kass.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 583, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 88, March 1964. 75 p, 10 fig, 19 tab, 26 ref. 14-01-001-177.

Descriptors: *Desalination, *Hydrates, *Hydrate processes, *Hydration, *Solubility, *Crystal growth, *Crystallization, Laboratory equipment, Calibration, Instrumentation, Measurement, Physical properties, Chemical properties, Physicochemical properties, Freezing.

New data on the solubilities of hydrating agents in water and salt solutions, two new phase diagrams on hydrate systems, and a description of work on crystal growth rates are presented. New data and calculations for the solubility of F-31 (CH_2ClF) in salt solutions, F-31 in pure water, new solubility data on F-142b, and revised solubility data for F-21 are discussed. Detailed calculations on the effects of solubility on the heats of formation and composition of three hydrates are presented. The apparatus used to obtain data for the chlorine-water and chlorine-water NaCl systems was completed and tested by determining several points on the phase diagram for F-152a (CH_3CHF_2) and methyl chloride. Ice crystal growth research during the period was primarily directed toward refining the apparatus and its operation. The experimental work involved various methods for growing and positioning seed crystals in flowing sub-cooled water. (Davison-IPA)
W79-06439

Group 3A—Saline Water Conversion

THE INFLUENCE OF ACOUSTICAL VIBRATIONS ON CONVECTIVE HEAT TRANSFER TO LIQUIDS,
Bolt Beranek and Newman, Inc., Cambridge, MA.
R. M. Fand.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 584, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 89, March 1964. 49 p, 9 fig. 14-01-0001-246.

Descriptors: *Desalination, *Acoustics, *Vibrations, *Equipment, *Laboratory equipment, Frequency, Heat transfer, Convection, Cavitation, Sound waves, Pumps, Heat exchangers.

Research to determine the effectiveness of acoustical vibrations as a means to increase heat transfer across a solid-liquid interface is reported. An experimental apparatus was developed in the form of a closed loop of piping through which water is pumped, and into which instrumented test specimens in the form of circular cylinders can be inserted. Controlled and measured acoustical vibrations must be created at the location where the test cyclinders are inserted. Calculations estimating the required intensity of the acoustical vibrations are presented. The function and operation of each of the 14 experimental apparatuses are discussed. Experimental heat transfer data were obtained under the following conditions: (1) natural convection without sound; (2) natural convection with sound, in the absence of and in the presence of cavitation; (3) forced convection without sound; and (4) forced convection with sound, in the absence of and in the presence of cavitation. The data show that acoustically induced cavitation significantly increases the rate of heat transfer across a solid-liquid interface, and that acoustical vibrations in the absence of cavitation do not appreciably affect the rate of heat transfer from a heated surface to a liquid for sound intensities up to 0.3 watts/sq cm. (Davison-IPA)
W79-06440

EXPANDED GLASSY POLYMERS AS REVERSE OSMOSIS MEMBRANES,
Massachusetts Inst. of Tech., Cambridge.
R. F. Baddour, W. R. Vieth, and A. S. Douglas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-189 421, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 144, September 1965. 88 p, 14 fig, 6 tab, 78 ref, 7 append. 14-01-0001-316.

Descriptors: *Desalination, *Desalination processes, *Desalination apparatus, *Reverse osmosis, *Membranes, *Fabrication, Permselective membranes, Semipermeable membranes, Plastics, Water treatment, Separation techniques, Water purification, Research and development, Materials testing.

Completed research on water and ion flux through modified poly(ethylene glycol monomethacrylate), and research in progress on the salt inclusion method of membrane preparation and membrane preparation by solvent control are reported. An evaluation of existing theories on the mechanism of water transport in reverse osmosis membranes led to the hypothesis that the degree of cross linking and the hydroxyl group content of a polymer were of major importance in determining its semipermeability. A series of crosslinked reinforced membranes was prepared to test this hypothesis. These membranes, copolymers of ethylene glycol monomethacrylate (EGM), ethylmethacrylate (EM) and ethylene glycol dimethacrylate (EGD), were tested under high reverse osmosis pressure with a sodium chloride solution; water sorption tests were also conducted. The degree of salt rejection exhibited by these membranes rose as the membrane was more tightly crosslinked, then dropped off sharply. It is concluded that crosslinking has a great effect on water sorpition. One membrane, one mill thick, prepared by the salt inclusion method provided 97.8% salt rejection with a flux rate of 0.5 gal/sq ft-day. An increase in the water permeability is expected with films cast using non-solvents in the casting solution. The effects of composition and properties of the solvent mixture on the desalination and flow properties of these membranes are being studied. (Davison-IPA)
W79-06441

SURVEY OF MATERIALS BEHAVIOR IN MULTI-STAGE FLASH DISTILLATION PLANTS,
Little (Arthur D.), Inc., Cambridge, MA.
E. H. Newton, and J. D. Birkett.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-200 924, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 512, December 1969. 95 p, 10 fig, 9 tab, 23 ref, 2 append. 14-01-0001-956.

Descriptors: *Desalination, *Desalination plants, *Desalination processes, *Flash distillation, *Construction materials, *Evaluation, Tubes, Heat exchangers, Pumps, Structural members, Corrosion, Descaling, Repairing, Maintenance, Separation techniques, Water purification, Water purity, Water treatment.

The performance of all structural, heat transfer, and equipment materials utilized in 55 large multistage flash distillation plants is surveyed. Data on the frequency of repairs, repair techniques, causes for component failures, the effectiveness of ensuing remedial action, and details of feed water treatment are presented for the heat exchanger tubes, tube sheets and demisters, water boxes, pump casings and impellers, and flash chambers. To determine the relative corrosion resistance of tube alloys and the corrosivity of inlet waters, a corrosion measuring instrument, the Corrater, was used. Insufficient time spent at any one of the installations for thorough checking of the technique may have been responsible for the lack of correlation between the measurements obtained and the experience with the materials. The many and varied reasons for plant shut-down or decreased production included: scale removal-acid cleaning, general maintenance, intake structure maintenance, water box repair, tube plugging and replacement, temperature imbalance, imbalance in steam distribution between power plant and evaporator in dual purpose plants, and steam boiler problems in single purpose plants. The plants in the survey represented nearly every variety of large multi-stage flash distillation plants currently in operation around the world. (Davison-IPA)
W79-06442

RESEARCH AND DEVELOPMENT OF NEW POLYMER SYSTEMS FOR REVERSE OSMOSIS MEMBRANES,
Aerojet-General Corp., Azusa, CA.
C. W. Saltonstall, Jr., W. S. Higley, and R. E. Kesting.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-176 354, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Deveopment Progress Report No. 167, February 1966. 43 p, 10 fig, 6 tab. 14-01-0001-435.

Descriptors: *Desalination, *Desalination apparatus, *Membranes, *Reverse osmosis, *Desalination processes, *Plastics permeability, Permselective membranes, Semipermeable membranes, Mass transfer, Fabrication, Films, Chemical properties, Physical properties, Water treatment, Separation techniques, Water purification.

Polyacrylonitrile (PAN), polymethacrylonitrile, and poly (vinylene carbonate) were selected in a program for developing reverse osmosis membranes with osmotic and mechanical properties and chemical stability superior to those of cellulose acetate membranes. These polymers were synthesized, and the membranes prepared from each exhibited semipermeable properties in reverse osmosis tests. PAN, selected because of its crystallinity and the high polarity of the nitrile group, was prepared with dimethylformanide (DMF) as the casting solution and heat treated in water. The membranes had fluxes of 16.5 to 21.0 gal/sq ft-day and salt retentions of 10 to 29% at 1500 psi when tested with a 3.5% sodium solution. The application of polymethacrylonitrile to the preparation of membranes was carried out because of its solubility in low-boiling solvents and its chemical similarity to polyacrylonitrile. Membranes prepared from a very-high-molecular-weight polymer had an average flux of 21.5 gfd and average salt retention of 10%. The poly (vinylene carbonate) membranes obtained exhibited salt retentions as high as 83% at low flux rates when tested at 1500 psi with 3.5% sodium chloride solution. Decreased salt retentions resulted when preparation conditions were altered to provide high fluxes. A comparison and evaluation of poly (vinylene carbonate) membranes with cellulose acetate membranes showed that salt retention expected from poly (vinylene carbonate) was one-third of that achieved with cellulose acetate at equivalent fluxes. (Davison-IPA)
W79-06443

THEORETICAL AND PRACTICAL ASPECTS OF THE EVALUATION OF CANDIDATE REVERSE OSMOSIS MEMBRANES FOR DESALINATION,
Office of Water Research and Technology, Washington, DC. Polymer and Biophysics Div.
H. E. Podell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-184 987, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 267, September 1967. 44 p, 4 fig, 8 ref, 1 append.

Descriptors: *Desalination, *Desalination processes, *Desalination apparatus, *Reverse osmosis, *Membranes Membrane processes, Permeability, Permselective membranes, Films, Equations, Laboratory testing, Evaluation, Separation techniques, Water treatment, Water purification, Physical properties, Thin films.

The reverse osmosis process is theoretically described with regard to the relevant transport equations and inherent membrane parameters that fully characterize a candidate membrane's permeation and permselectivity properties. The experimental methodology and recommended test conditions for determining these inherent properties and for evaluating various membranes for use in the process are presented. (Davison-IPA)
W79-06444

REVERSE OSMOSIS FOR WATER DESALINATION,
General Atomic Co., San Diego, CA.
H. K. Lonsdale, U. Merten, R. L. Riley, and K. D. Vos.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-177 079, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 150, October 1965. 88 p, 37 fig, 16 tab, 43 ref. 14-01-0001-250.

Descriptors: *Desalination, *Desalination apparatus, *Membranes, *Reverse osmosis, *Fabrication, Laboratory testing, Plastics, Polymers, Deterioration, Mass transport, Transport depletion, Hydrolysis, Separation techniques, Water treatment, Water purification.

Research emphasizing lifetime studies of cellulose acetate membranes, and investigations of alternative membrane materials are reported. Although lifetime studies of cellulose acetate membranes show that the deterioration in salt rejection commonly observed in reverse osmosis systems can be controlled, the problems of marginal salt rejection and marginal flow rates after extended periods of use remain. Life test results performed on cellulose acetate membranes and evidence relating some of the observed time-dependent effects to hydrolysis of the acetate are presented. A study of the hydrolysis reaction is reported, and the quantitative relationship between hydrolysis and membrane deterioration rate is examined. The theoretical approach to membrane permeability emphasizes those aspects important in the preliminary evaluation of membrane materials. Results obtained from transport studies of cellulose acetate membranes

are presented. Studies crosslinking polyvinylpyrrolidone (PVP) are discussed. It was found that crosslinking with MDI was an effective method of insolubilizing PVP and obtaining membranes with desired water content. The potential new membrane materials investigated included nylon, polyvinyl butyral, cellulose acetates with higher acetyl content, cellulose butyrates, oxidized cellulose acetate, and other hydrophilic materials. Although nylon looks promising in terms of permeability and salt rejection, it looses its favorable physical properties as it becomes more hydrophilic. (Davison-IPA)
W79-06445

POLYELECTROLYTE COMPLEXES AS REVERSE OSMOSIS AND ION-SELECTIVE MEMBRANES,
Massachusetts Inst. of Tech., Cambridge.
A. S. Michaels, H. J. Bixler, R. W. Hausslein, and S. M. Fleming.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-177 078, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 149, December 1965. 90 p, 30 fig, 3 tab, 28 ref. 14-01-0001-315.

Descriptors: *Desalination, *Desalination processes, *Reverse osmosis, *Membranes, *Fabrication, Desalination apparatus, Polymers, Plastics, Mass transfer, Aqueous solutions, Solvents, Separation techniques, Water treatment, Water purification.

A brief discussion of research completed on polysalt complex membranes and transport mechanisms in cellulose acetate membranes is followed by a report of the detailed investigation being carried out on polysalt complex membranes. A preliminary investigation revealed that polysalt complexes are potentially superior desalination membrane materials, but the lack of very efficienct consolidation techniques is a major obstacle in their development. Results of the investigation of transport mechanisms in cellulose acetate reverse osmosis membranes indicate that the high desalination efficiency of these membranes is mostly due to the high concentration and high diffusivity of water in the polymer, and the low concentration and low diffusivity of ionic solutes. Polysalt complex membranes prepared by casting from polysalt complex-ternary water solutions, a water-miscible organic solvent, and a strong electrolyte were tested with 4% aqueous sodium chloride solutions at 1500 psi. The most successful membrane preparation procedures involved casting a 10 mil thickness of 18% polysalt in water, dioxane, HCl ternary, gelling in an oven at 50C for 25 minutes, and washing in water at room temperature. These membranes exhibit salt rejections of 50% and water fluxes of 2 gal-mil/sq ft-day. Other preparation methods such as the use of the hydrobromic acid-methyl cellusolve solvent system are being studied. Correlation of the reverse osmosis data with the water content of the membrane was made. (Davison-IPA)
W79-06446

INVENTORY OF PUBLISHED AND UNPUBLISHED DATA ON THE CHARACTERISTICS OF SALINE SURFACE AND GROUND WATERS OF SOUTH DAKOTA,
South Dakota School of Mines and Technology, Rapid City. Engineering and Mining Experiment Station.
E. H. Tullis, J. P. Gries, and J. H. Cope.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-161 381, Price codes: A08 in paper copy, A01 in microfiche. Final Report, June 1954. 154 p, 8 fig, 2 tab, 19 ref. 14-01-001-56.

Descriptors: *Data collections, *Saline water, *South Dakota, Surface waters, Groundwater, Watersheds(Basins), Publications, Drilling, Testing.

A compilation of data collected from literature on saline water analysis in South Dakota is presented. After a geological discussion of the groundwater of this area data on the analysis of both surface and groundwater are tabulated, and referenced with the appropriate bibliographic reference number. All analyses are sequentially numbered and locations for them are given on record sheets. An index of the analyses pertaining to the drainage basins of surface waters is included. Available information on 31 drill stem tests run on deep oil and water is tabulated. The extensive bibliography includes both published and unpublished sources. (Davison-IPA)
W79-06447

COST STUDIES OF LARGE MULTI-STAGE FLASH SALINE WATER CONVERSION PLANTS.
Bechtel Corp., San Francisco, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-166 254, Price codes: A17 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 116, October 1964. 279 p, 43 fig, 25 tab, 13 ref, 2 append. 14-01-0001-313.

Descriptors: *Desalination, *Desalination plants, *Desalination processes, *Multi-stage flash evaporation, *Design criteria, *Estimated costs, Capital costs, Water costs, Construction, Construction materials, Concretes, Cost analysis, Heat balance, Temperature, Saline water, Separation techniques, Water treatment, Water purification.

A study was undertaken to determine the cost reductions of converting sea water to fresh water resulting from increasing the scale of operations, and using exhaust steam from a gas-fueled power generating station as a heat supply for the conversion plant. Seven specific cases of the multi-stage flash evaporation process were selected, and the entire study was based on a common set of site and design criteria. Results of a preliminary study indicate that coated concrete could be used for construction of evaporators for temperatures up to 250F. After work was under way, optimized evaporator designs and capital estimates of water conversion facilities were developed for 16 cases with the following ranges of steam costs and brine and sea water temperatures: steam costs of 5, 15, 25, and 35 cents/M lbs; brine temperatures of 250F and 300F; and sea water temperatures of 65F and 85F. A computer program was developed to solve the heat and material balances of the process scheme. Capital cost estimates were developed and tabulated so that the cost of water could be computed for each of these cases. Optimum plant configurations and the capital cost estimates are tabulated. A general description of the water plant and power plant are presented, and the discussion of specific plants includes equipment lists, data on the heat and material balances, and the opimum computer run. Drawings of the specific plants are provided. (Davison-IPA)
W79-06448

3B. Water Yield Improvement

A STATISTICIAN'S VIEW OF WEATHER MODIFICATION TECHNOLOGY (A REVIEW),
California Univ., Berkeley. Statistical Lab.
For primary bibliographic entry see Field 2B.
W79-06045

CLOUD PHYSICS AND WEATHER MODIFICATION.
For primary bibliographic entry see Field 2B.
W79-06046

GEOLOGIC APPLICATIONS OF LANDSAT IMAGES IN NORTHEASTERN ARIZONA TO THE LOCATION OF WATER SUPPLIES FOR MUNICIPAL AND INDUSTRIAL USES,
Arizona State Univ., Tempe. Dept. of Geology.
For primary bibliographic entry see Field 2A.
W79-06164

3C. Use Of Water Of Impaired Quality

WEYERHAEUSER'S RAISING SALMON – USES MILL COOLING WATER AT HATCHERY,
P. I. Meadors.
Pulp and Paper, Vol. 42, No. 12, p 148-149, November, 1978. 1 fig, 3 illus.

Descriptors: *Cooling water, *Pulp and paper industry, *Water reuse, *Fish hatcheries, Wastes, Industrial wastes, Water pollution sources, Effluents, Oregon, Salmon, Chinook salmon, Coho salmon, Chum salmon, Fisheries, Fish, Aquatic animals.

Hot water (7,000,000 gal/day) from the cooling system at Weyerhaeuser Co.'s linerboard mill (Springfield, Oregon) is piped 2.25 miles to the $7,000,000 salmon hatchery. This water is combined with river water to maintain a temperature of 55F, thus reducing the rearing time for chinook, chum, and coho salmon from 18 to 6 months. (Swichtenburg-IPC)
W79-06118

3D. Conservation In Domestic and Municipal Use

METHOD FOR RECYCLING PAPER MILL WASTE WATER,
R. C. O'Brien.
United States Patent No. 4,115,188. Issued September 19, 1978. 7 p. 10 claims. 1 fig.

Descriptors: *Pulp wastes, *Waste water treatment, *Coagulation, *Water reuse, *Patents, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Pulp and paper industry, Effluents, Hydrogen ion concentration, Recycling, Neutralization, Sludge, Landfills, Fuels, Waste disposal, White water(Paper machines), Sulfuric acid, Solid wastes.

A method for processing paper mill white water involves adding sulfuric acid to reduce the pH below 4, mixing thoroughly, adding calcium hydroxide to raise the pH to above 10, and separating the coagulated solids so formed. The clarified water can be recycled (after neutralizing) as a major source of water for the papermaking process; the coagulated solids can be used as landfill, as a low-grade pulp source, or as fuel. (Lynch-IPC)
W79-06115

FEDS PUSH FOR WHOLLY INTEGRATED STATE/EPA PROGRAMS,
For primary bibliographic entry see Field 5G.
W79-06297

3E. Conservation In Industry

SOME ASPECTS OF PROPER WATER MANAGEMENT IN PAPER MILLS (NIEKTORE ASPEKTY RACJONALNEGO KSZTALTOWANIA WODNO-MASOWYCH OBIEKTOW PAPIERND,
Instytut Celulozowo-Papierniczy, Lodz (Poland).
A. Kowalczyk.
Przeglad Papierniczy, Vol. 34, No. 8, p 301-305, August, 1978. 7 fig, 18 ref, 1 tab.

Descriptors: *Water conservation, *Pulp and paper industry, Industrial water, Recycling, Water pollution sources, Pulp wastes, Water reuse, Closed systems, White water(Paper machines), Effluents, Capital costs, Costs, Water pollution control, Paper machines, Saveails.

Ways to reduce fresh water consumption in paper mills are discussed, including increasing the consistency of the stock supplied to the mill, reducing the amount of fresh water supplied directly to the paper machine (for showers, seal water, etc.), sepa-

rating white water from other wastes before treatment, proper selection and mounting of savealls, coordinating water circuits on the paper machine and the mill as a whole, and controlling water circuits on the machine with flow meters and consistency meters. The first step in a water management program should be reduction of fresh water consumption to 25-40 cu m/ton of paper through modernization and modification of the paper machine water circuit, including partial water recycling. Such reduction is relatively easy to achieve at low investment costs and is free of problems experienced in mills with a closed water cycle. (Stapinski-IPC)
W79-06119

CONSIDERATIONS IN PROCESS WATER REUSE IN NON-INTEGRATED PAPER MANUFACTURING,
Miami Univ., Oxford, OH.
A. M. Springer.
Paperi ja Puu, Vol. 60, No. 11, p 705-706, 709-712, 715-716, November, 1978. 7 fig, 11 ref, 3 tab.

Descriptors: *Paper mills, *Water conservation, *Water pollution control, Model studies, Pulp and paper industry, Effluents, Water pollution sources, Water reuse, Economics, Costs, Recycling, Industrial water, Suspended solids, Dissolved solids, Closed systems, Fine papers, White water(Paper machines).

A model fine-paper mill is analyzed for possible elimination of effluent discharge. Potential economic benefits from water, fiber, filler, and energy savings amount to $7.70/1000/kg (or $7.00/U.S. ton) for this model, and these savings must offset the cost of process modifications. A set of possible modifications to achieve total water recirculation is presented. Problems which may arise from water-conservation efforts include felt and wire plugging, corrosion, scale deposits, foaming, slime and odor formation, nonuniform sizing degree and paper color, and other difficulties affiliated with buildups of suspended solids and/or dissolved solids in the closed water circuit. These problems may prevent total system closure in practice. A steady-state mass balance calculation indicates a rapid acceleration of dissolved-solids accumulation in the white water at effluent levels below 12.5 cu m/1000 kg (3000 gal/ton) of paper produced. (Brown-IPC)
W79-06120

A REVIEW OF INDUSTRY EXPERIENCE WITH SELECTED INTERNAL PROCESS SOLIDS SEPARATION DEVICES,
National Council of the Paper Industry for Air and Stream Improvement, Inc., New York.
J. E. McCourt.
NCASI Stream Improvement Technical Bulletin, No. 314, 57 p, August, 1978. 2 appendices, 73 ref, 5 tab.

Descriptors: *Pulp wastes, *Waste water treatment, *White water(Paper machines), Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Pulp and paper industry, Effluents, Water reuse, Separation techniques, Recycling, Industrial water, Equipment, Savealls, Filters, Screens, Water conservation.

A survey is presented of the capabilities of equipment used in white water reuse schemes, namely, pre-saveall devices, savealls (drum, disk, or flotation), and in-line strainers/filters. This review focuses on the use, role, and importance of post-saveall devices in providing white water of uniform quality, hence enhancing the possibility for continuity of operation and more extensive water reuse in the papermaking process. Reported experiences with post-saveall solids removal devices are described, namely, fine-screen fractionators (A. B. Floatwash and Celleco microsorter), sidehill screen derivatives (DSM screen), centrifugal fine screens (SWECO, CSC), and microstrainer units (North filter, Sinclair rotary filter). More detailed knowledge is needed of the capability and feed water quality. This information may be obtained in well designed field studies at existing installations by incorporating continuous flow measurements and on-line continuous suspended solids measurements at currently successful solids removal systems preceding machine showers. Such a study also lends itself to pilot trials of an array of available devices. (Swichtenberg-IPC)
W79-06123

FEDS PUSH FOR WHOLLY INTEGRATED STATE/EPA PROGRAMS,
For primary bibliographic entry see Field 5G.
W79-06297

3F. Conservation In Agriculture

REUSE PITS: CHEAPEST WATER ON THE FARM,
J. G. White.
Irrigation Age, Vol. 13, No. 3, p 58, 62, November-December, 1978. 2 fig.

Descriptors: Tailwater, Water conservation, Irrigation efficiency, Irrigation, Crop production, Irrigation practices, Nebraska, Agricultural runoff.

Described are the benefits of using tailwater pits as experienced by farmers in Nebraska. Pumping cost was reduced by one-fourth compared with the cost of pumping from deep wells, reduced time and labor, and reduced the amount of deep-well water use by 20%. It was estimated that the gravity irrigation efficiency was increased by almost 15%. (Skogerboe-Colorado State)
W79-06031

GROUND-WATER CONTAMINATION BY FERTILIZER NITROGEN,
Science and Education Administration, Fort Collins, CO.
For primary bibliographic entry see Field 5G.
W79-06081

FEDS PUSH FOR WHOLLY INTEGRATED STATE/EPA PROGRAMS,
For primary bibliographic entry see Field 5G.
W79-06297

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

SIMULATION OF STREAMFLOW OF ROCK RIVER AT LAKE KOSHKONONG, WISCONSIN, TO DETERMINE EFFECTS OF WITHDRAWAL OF POWERPLANT-COOLING WATER,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 6A.
W79-06315

EFFECTS OF MECHANICAL AGITATION ON DRYING RATE OF FINE-GRAINED DREDGED MATERIAL,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
T. A. Haliburton, G. N. Durham, K. W. Brown, R. E. Peters, and T. B. Delaney, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A044 843, Price codes: A07 in paper copy, A01 in microfiche. Technical Report D-77-10. September 1977. 121 p, 54 fig, 13 tab, 74 ref, 3 append.

Descriptors: *Dredging, *Slurries, *Dewatering, *Mixing, *Evaporation, Evaporation control, Evaporation pans, Sludge treatment, Surface drainage, Landfills, Waste disposal.

An evaluation of methods for the evaporative dewatering of fine-grained dredged material slurry compared continuous agitation at controlled sites during periods of high and low evaporative demand and periodic agitation to desiccate the crust. A theoretical analysis of the factors controlling evaporation of soil slurries was performed prior to field tests. Fine-grained dredged slurries were treated: in a small-scale controlled agitation experiment under conditions of low evaporative demand; in a large-scale controlled agitation experiment under high evaporative demand conditions; and in a six-month field demonstration of periodically mixing the surface desiccation crust and underlying highly moist dredged materials. Results of the study indicated that agitation of highly plastic clay slurries does not significantly influence the rate of evaporative water loss or slurry volume reduction compared to unagitated samples. The surface area of the shrinkage cracks provided additional evaporation which offset any decrease in the rate of evaporative drying. The standard Class A Pan Evaporation procedure can approximate the maximum rate of evaporation in highly plastic clay slurries; the duration of these rates are dependent upon soil properties, initial water content, water table location, and climatic conditions. Periodic mixing can improve material subsidence, but improving surface drainage and removing water rapidly were considered better alternatives in confined disposal areas. (Link-FIRL)
W79-06339

4B. Groundwater Management

CALIFORNIA GROUNDWATER REPORT: IT'S FINALLY IN,
For primary bibliographic entry see Field 6E.
W79-06002

SACRAMENTO VALLEY: A VAST UNDERGROUND RESERVOIR,
California State Dept. of Water Resources, Red Bluff. Northern District.
P. J. Lorens.
Pacific Groundwater Digest, Vol 2, No 2, p 8-12, February, 1979. 3 fig, 1 tab, 4 ref.

Descriptors: *Ground water basins, *Geohydrologic units, Irrigation wells, Withdrawal, Conjunctive use, Storage, Specific yield, Drillers logs, Water level, California, Sacramento Valley.

The ground water basin underlying the Sacramento Valley is second largest in California. It stores as much water as all the surface reservoirs in the state combined. There is a wide variation in ground water quantity and quality both between and within the geologic formations composing the basin. The use of ground water for irrigation in the valley has been steadily increasing since the early 1900's. By 1950 a pumping depression developed in Solana County due to increased ground water withdrawals. However, in recent years, ground water levels have been rising due to greater use of imported surface water. The largest pumping depression is in Sacramento County, the result of many years of pumping. With conjunctive-use management, ground water would be used during dry periods, and during the wet season, the basin would be recharged by percolation of streamflow, infiltration of unused irrigation water, and precipitation. The total volume of ground water in storage in the Sacramento Valley was estimated at 113,700,000 acre-feet for 1965 water level conditions in a depth zone ranging from 20 to 600 feet from the ground surface. This estimate was based on assigning specific yield values to materials described in driller's logs. (Purdin-NWWA)
W79-06006

CHOOSING A POTABLE WATER SUPPLY: WHAT YOU NEED TO KNOW,
New Jersey Inst. of Tech., Newark.
For primary bibliographic entry see Field 6B.
W79-06008

DATING GROUND WATER.
For primary bibliographic entry see Field 2F.
W79-06016

NUMERICAL MODELLING OF AN AQUIFER SYSTEM WITH INTERMITTENT RECHARGE,
James Cook Univ., North Queensland (Australia). Dept. of Civil Engineering.
R. E. Volker.
Australian Water Resources Council Technical Paper No 25, 1977, 64 p, 26 fig, 47 ref.

Descriptors: *Digital computers, *Model studies, *Aquifers, Coasts, Groundwater recharge, Artificial recharge, Discharge(Water), Water levels, Saline water intrusion, Water management(Applied).

A digital model is presented which will evaluate the quantity and quality of groundwater from the Burdekin Delta on the North Queensland coast. The model takes into account both natural and artificial recharge conditions and the saline water-freshwater interface near the cost in predicting water levels at any particular time under the influence of given recharge or pumping rates. Results from the model indicate that average water levels in the last ten years would have been considerably lower if artificial recharge had not been carried out. One requirement of the model is a reliable method for determining recharge or discharge under assumed or actual climatic conditions. Also, needed are accurate field data from which recharge and discharge can be estimated. Models which determine seawater intrusion are also described and some results obtained from them are presented. Short term lowering of water levels will not result in significant intrusion. (Purdin-NWWA)
W79-06020

FEDS PUSH FOR WHOLLY INTEGRATED STATE/EPA PROGRAMS,
For primary bibliographic entry see Field 5G.
W79-06297

SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES--LOWER MISSISSIPPI REGION,
Geological Survey, Little Rock, AR. Water Resources Div. and Geological Survey, Baton Rouge, LA. Water Resources Div.
J. E. Terry, R. L. Hosman, and C. T. Bryant.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $1.90. Geological Survey Professional Paper 813-N, 1979. 41 p, 26 fig, 1 tab, 54 ref.

Descriptors: *Groundwater resources, *Evaluation, *Regional analysis, *Gulf Coastal Plain, Groundwater availability, Water quality, Water wells, Water yield, Aquifers, Water utilization, Water supply, Water demand, Water level fluctuations, Groundwater recharge, Surface-groundwater relationships, Saline water intrusion, Desalination, Aquifer management, Water conservation, Groundwater potential, *Lower Mississippi River basin.

The Lower Mississippi Region, and area of 102,400 square miles, lies mostly in the Gulf Coastal Plain physiographic province. Three small areas on the northwest boundary are in the Interior Highlands. An abundance of fresh ground water is available in the region--about 844 billion cubic feet annually. Only about one-third of this available supply is being used. The largest use of ground water in the region is for irrigation. Saltwater occurs throughout the region in the lower limits of the aquifers. The quantity of saltwater available is several times that of freshwater. As desalination techniques are perfected, and as more uses are found for saltwater, it will become an increasingly valuable resource. Water-resource development and related activities should include adequate consideration of ground water. Also, activities such as large-scale construction and mining excavations should be well planned and their impact upon the groundwater regime carefully evaluated. (Woodard-USGS)
W79-06308

LAND TREATMENT OF WASTEWATER AT WEST DOVER, VERMONT,
Army Terrestrial Sciences Center, Hanover, NH.
For primary bibliographic entry see Field 5E.
W79-06341

4C. Effects On Water Of Man's Non-Water Activities

URBANIZATION AND CHANGES IN PRECIPITATION, A STATISTICAL APPROACH,
Royal Netherlands Meteorological Inst., De Bilt.
For primary bibliographic entry see Field 2B.
W79-06248

HYDROLOGIC DATA FOR URBAN STUDIES IN THE DALLAS, TEXAS METROPOLITAN AREA, 1976,
Geological Survey, Austin, TX. Water Resources Div.
B. B. Hampton, and C. M. Wood.
Geological Survey open-file report 78-437, June 1978. 163 p, 4 fig, 3 tab, 7 ref.

Descriptors: *Urban hydrology, *Storm runoff, *Rainfall-runoff relationships, *Flood profiles, *Hydrologic data, Urban runoff, Streamflow, Hydrographs, Mass curves, Texas, *Dallas area.

This report contains rainfall and runoff data collected during the 1976 water year for drainage basins of Joes Creek, Bachman Branch, Turtle Creek, Coombs Creek, Cedar Creek, White Rock Creek, Elam Creek, Fivemile Creek, Newton Creek, Whites Branch, Prairie Creek, Tenmile Creek, Duck Creek, and South Mesquite Creek in the Dallas metropolitan area. The information will be useful in determining the extent to which progressive urbanization will affect the yield and mode of occurrence of storm runoff. Detailed rainfall-runoff computations, including hydrographs and mass curves, are presented for six storm periods during the 1976 water year. During the 1976 water year, one continuous stream-gaging station and two flood-hydrograph partial-record stations were added to the study area. These stations are located in the Prairie Creek basin. (Woodard-USGS)
W79-06314

RECOMMENDATIONS FOR BASELINE RESEARCH IN WASHINGTON AND OREGON RELATIVE TO OFFSHORE RESOURCE DEVELOPMENT.
For primary bibliographic entry see Field 5C.
W79-06468

AN ANALYSIS OF THE FEASIBILITY OF SEPARATING EXPLORATION FROM PRODUCTION OF OIL AND GAS ON THE OUTER CONTINENTAL SHELF.
Office of Technology Assessment, Washington, DC.
For primary bibliographic entry see Field 6A.
W79-06473

4D. Watershed Protection

ENVIRONMENTAL BASELINE DESCRIPTIONS FOR USE IN THE MANAGEMENT OF FORT CARSON NATURAL RESOURCES. REPORT 4. ANALYSIS AND ASSESSMENT OF SOIL EROSION IN SELECTED WATERSHEDS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Systems Div.
M. P. Keown, and H. W. West.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A052 347, Price codes: A06 in paper copy, A01 in microfiche. Technical Report M-77-4, February 1978. 82 p, 37 fig, 4 tab, 19 ref, 4 append.

Descriptors: *Watersheds(Basins), *Watershed management, *Fort Carson(CO), *Military reservations, *Soil erosion, *Watershed Erosion Index, *Environmental effects, *Military training areas, *Small watersheds, Baseline studies, Colorado, Resource management, Topsoil, Soil types, Rocky Mountain Region, Rainfall, Topography, Methodology, Analytical techniques, Sediments, Sedimentation, Land use, Universal Soil Loss Equation, Mathematical studies, Equations, Forecasting, Soil conservation, Mapping, Slopes.

The Watershed Erosion Index (WEI) was developed to predict average annual sediment yield for watersheds on Fort Carson military reservation, Colorado, two-thirds of which is intensively used for mechanical army infantry training. Training activities have seriously damaged trees and grass cover in this semiarid, fragile ecosystem. WEI, a modified version of the Universal Soil-Loss Equation, provides reliable engineering data in designing soil conservation measures. Soil losses in the six study watersheds were not significantly different from those of other small watersheds in the Rocky Mountain foothills region, but over most of Fort Carson the annual topsoil formation rate is probably less than the annual soil-loss rate because of: (1) the relatively slow rate of natural revegetation and vegetative growth due to low annual precipitation, (2) exposure of large training areas to wind erosion, and (3) the frequency and intensity of troop training. Recommendations: (1) further validate the methodology, (2) develop a computer program to calculate average annual sediment yield, (3) estimate effective life of other basins at Fort Carson that are silting in at a rapid rate, and (4) determine basin capacity required for sediment retention in all future engineering design studies for new construction at Fort Carson. Data requirements for WEI use include rainfall, soil erodibility, slope-length and gradient, and composite land use factors, and the percent of the watershed occupied by the field mapping unit. (Lynch-Wisconsin)
W79-06043

METHODS TO CONTROL FINE-GRAINED SEDIMENTS RESULTING FROM CONSTRUCTION ACTIVITY,
Hittman Associates, Inc., Columbia, MD.
M. A. Nawrocki, and J. M. Pietrzak.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 092, Price codes: A05 in paper copy, A01 in microfiche. Report No. EPA 440/9-76-026, December 1976. 83 p, 11 fig, 11 tab, 39 ref, 1 append. 68-01-3260.

Descriptors: *Sediment control, *Construction, *Pollution abatement, Water pollution control, Erosion control, Particle size, Technology, Sediment transport, Suspended solids, Retention, Storage.

The most promising control alternatives for increasing the amount of fine-grained sediment retained at a construction site are summarized from current technology as described in literature. Use of a specific technique or combination of techniques depends upon the degree of fine-grained sediment control required and the characteristics of the soils at the site. The four general categories for the control of fine-grained sediment closely follow the implementation of a standard erosion and sediment control plan. The first category consists of standard techniques used on construction sites which tend to reduce the production of sediment at the site. The second category involves the use of adequate control measures including sediment traps, sediment filters and baffles, and sediment ponds to retain the fine-grained sediment on site. The third category involves the installation of mechanical separation devices capable of removing fine-grained particles from water at the overflow structure of the retention ponds. The last technology includes the removal, dewatering, drying, and perhaps, the use of the sedimentary materials. It is concluded that: overall control of fine-grained sediments can be achieved by modification and expansion of a standard erosion and sediment control plan; fences constructed of plastic filter cloth

appear to be one of the most effective control devices; and modifications of detention ponds including the installation of baffles and the provision of a more effective length to width ratio will achieve more removal of these sediments. (Davison-IPA)
W79-06101

OLD WOMAN CREEK, OHIO: THE DESIGNATION OF A FRESHWATER ESTUARINE SANCTUARY,
Ohio Dept. of Natural Resources, Columbus.
For primary bibliographic entry see Field 6E.
W79-06301

UTILIZATION OF SEWAGE SLUDGE FOR TERRAIN STABILIZATION IN COLD REGIONS,
Army Terrestrial Sciences Center, Hanover, NH.
For primary bibliographic entry see Field 8D.
W79-06342

PLANTING GUIDELINES FOR MARSH DEVELOPMENT AND BANK STABILIZATION,
Coastal Engineering Research Center, Fort Belvoir, VA.
P. L. Knutson.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A046 547, Price codes: A02 in paper copy, A01 in microfiche. Report CETA-77-3, 1977. 21 p, 3 fig, 2 tab, 9 ref, 3 append.

Descriptors: Erosion control, *Bank stability, Soil stabilization, *Marsh management, *Vegetation establishment, Marshes, *Marsh plants, Labor, *Planting management, Seeds, Fertilization.

Guidelines are presented for the use of marsh plants in stabilizing eroding banks and for marsh development. The selection of plants and planting methods and the determination of seed application rate and plant spacing are discussed. Determination of fertilization requirements and estimation of labor for planting on a project-by-project basis, are also discussed. Four types of cordgrass are considered including Smooth, Gulf Coast, California, and Saltmeadow. This report supplements Chapter 6 of the Shore Protection Manual of the US Army Corps of Engineers (1975). (Small-FIRL)
W79-06376

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

NITRATE ANALYZER MONITORS AILING WELL,
Garden City Park Water District, NY.
M. R. Sheinker, and R. Krumholz.
Water and Wastes Engineering, Vol 16, No 2, p 37-38, February, 1979, 2 fig.

Descriptors: *Nitrates, *Water quality control, *Monitoring, Ion exchange, Ground water, Denitrification, Human diseases.

Because of the strong correlation between high nitrate content in drinking water and the disease, methemoglobinemia, government regulations require continuous monitoring to see that the nitrate level does not exceed the 10 mg/l limit established as safe. The water treatment plant for Garden City Park, New York, uses a closed-loop ion exchange system to remove nitrates and an on-line Series 8138 S.I.E. analyzer to automatically and continuously measure the nitrate concentration of the denitrified product. The analyzer automatically shuts the system down if a level of 9.9 mg/l nitrate as nitrogen is detected or if a zero reading is recorded due to a reagent or analyzer failure. (Purdin-NWWA)
W79-06007

QUALITY ASSURANCE PROGRAM FOR TRACE HYDROCARBON ANALYSIS,
National Bureau of Standards, Washington, DC. Analytical Chemistry Div.
S. N. Chesler, H. S. Hertz, W. E. Wise, and S. A. Wise.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol VIII, Contaminant Baselines, p 1-10, October 1978. 3 tab, 6 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 01-6-022-11469.

Descriptors: *Laboratory tests, *Pollutant identification, *Oil pollution, Water pollution sources, Path of pollutants, Baseline studies, Environmental effects, Resources development, Water quality, Alaska, *Outer Continental Shelf, *Hydrocarbons, Quality control.

During the past year the National Bureau of Standards (NBS) has conducted an interlaboratory comparison study on samples of Mytilus homogenized by NBS and has acted as a consultant laboratory to other NOAA Principal Investigators involved in hydrocarbon analysis of marine waters, sediments and tissues. Results to date have shown that there is an urgent need for a strong quality assurance program within the Outer Continental Shelf plan. Since the chemical data reported to NOAA originates from several different laboratories, it is imperative that these data be uniform in quality so that there is a basis for comparability of the data. The experimental results of a sediment comparison study are summarized in tables and the methods used by each laboratory are also summarized in tabular form. (Sinha-OEIS)
W79-06021

IDENTIFICATION OF NATURAL AND ANTHROPOGENIC PETROLEUM SOURCES IN THE ALASKAN SHELF AREAS UTILIZING LOW MOLECULAR WEIGHT HYDROCARBONS,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
J. Cline, R. Feely, and A. Young.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol VIII, Contaminant Baselines, p 73-198, October 1978. 49 fig, 6 tab, 6 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Baseline studies, *Oil spills, *Pollutant identification, Path of pollutants, Water pollution sources, Resources development, Water pollution effects, Environmental effects, Alaska, *Outer Continental Shelf, *Hydrocarbons, Petrogenic hydrocarbons, Biogenic hydrocarbons.

The development of petroleum resources in the Alaskan OCS may result in the release of toxic hydrocarbons to the marine environment. Increases in the natural levels of petroleum-derived hydrocarbons are likely to occur from the normal activities associated with exploration, production and transportation of crude and refined products within the region. Thus, it is of environmental significance that baseline levels of both naturally occurring and petroleum-derived hydrocarbons be established prior to the development of fossil fuel resources in the area, and that attention be focused in the sources and residence times of these components. The principal concern surrounding the distributions, sources, and sinks of low molecular weight hydrocarbons (LMWH) is not their direct impact on biota, but rather their role as tracers of more toxic hydrocarbon fractions commonly found in crude oils. Of particular value is the use of LMWH to identify probably trajectories of the toxic dissolved fractions during a spill, well blowout, or pipeline rupture. Because some of the hydrocarbons common to petroleum are also manufactured by marine organisms, it becomes necessary to evaluate the normal background levels of hydrocarbons before an accurate assessment of anthropogenic input can be made. The overall objective is to provide the criteria for an early warning detection of petroleum-derived hydrocarbons and to establish the feasibility of using LMWH as dispersion tracers, particularly in reference to near-bottom and resuspension processes. (Sinha-OEIS)
W79-06023

ASSESSING NITROGEN CONTAMINATION BY USE OF DIFFERENTIAL TEMPERATURE CALCULATIONS,
Whiteley-Jacobsen and Associates, Seattle, WA.
A. H. Benedict, and A. LeSouf.
Water Research, Vol 12, No 12, p 1107-1112, 1978. 8 fig, 2 tab, 13 ref.

Descriptors: *Nitrogen, *Aisne River(France), *Water pollution effects, *Equations, *Nitrogenous oxygen demand, *Biochemical oxygen demand, Carbon, Oxygen, Anaerobic conditions, Oxygen depletion, Rivers, France, Methodology, Analytical techniques, Mathematical studies, Industrial wastes, Municipal wastes, Water pollution sources, Pulp wastes, Ammonia, Ammonium, Oxygen requirements.

Nitrogenous oxidation accounts for about 38% of total oxygen demand requirements in the lower Aisne River, a subtributary of the Seine River in northern France, according to a methodology which defines the relative influences of nitrogenous and carbonaceous oxygen requirements. The methodology is based on definition of relative differences between BOD and nitrogenous oxygen requirements under warm (19-23C) and cold (2-6C) temperature regimes in the Aisne. The Aisne in the study area received point load contaminants from four industries (including a large ammonia-based pulping operation), the town os Soissons, and the Vesle River which receives wastes from the city of Reims. Mean monthly ammonia loadings to the Aisne were similar in winter and summer. Differential net nitrogen conversion resulting from the combined effects of ammonification and nitrogenous oxidation decreased with increasing flow rate (decreasing hydraulic residence time). At a flow of five cu m/sec there was a differential net conversion of 4.49 mg ammonium/l, while at a flow rate of 60 cu m/sec differential net conversion was 0.64 mg ammonium/l. Available data did not permit evaluation of the direct effect of ammonification. Anaerobic conditions could be expected in the Aisne if reaeration and photosynthetic oxygenation did not offset the requirements calculated. The relative influence of nitrogenous and carbonaceous oxidation would vary if other temperature regimes were used. (Lynch-Wisconsin)
W79-06034

PROCEEDINGS OF THE FIRST WORKSHOP ON SAMPLING GEOTHERMAL EFFLUENTS.
For primary bibliographic entry see Field 2F.
W79-06052

GEOTHERMAL EFFLUENTS, THEIR TOXICITY AND PRIORITIZATION,
Woodward-Clyde Consultants, San Francisco, CA.
For primary bibliographic entry see Field 5B.
W79-06054

SOME PROBLEMS INVOLVED WITH SAMPLING GEOTHERMAL SOURCES,
Los Alamos Scientific Lab., NM.
A. K. Stoker, and W. D. Purtymun.
In: Proceedings of the First Workshop On Sampling Geothermal Effluents; Workshop held October 20-21, 1975, Las Vegas, Nevada. Report EPA-600/9-76-011, p 67-95, May 1976. 7 fig, 1 tab, 12 ref. ERDA W-7405-ENG36.

Descriptors: *Geothermal studies, *Thermal water, *Sampling, *Data collections, Methodology, Variability, Water vapor, Steam, Condensation, Analytical techniques, Chemicals, Carbon dioxide, Chlorides, Laboratory tests, Flow, Flow rates, Radioisotopes, Wells, Water wells, Groundwater.

Geothermal wells must be sampled for a variety of purposes, including geologic and geological interpretation, engineering design of facilities, environmental release evaluation, and documentation of baseline conditions. Basic factors influencing the choice and application of sampling methods were reviewed, including the type of the geothermal resource, the analyses of interest, well production parameters, utilization processes, and possible sample contamination or instability. Three basic methods of sampling were described: condensation, phase separation, and use of evacuated containers. Several practical problems experienced by various workers were discussed. The problems discussed included the natural variability of fluid composition with time, effects of well-bore heat losses, effects of well flow rate and production time, sampling locations, laboratory simulation studies, contamination by corrosion reactions, and documentation of hydrologic systems possibly connected to the geothermal resource. (See also W79-06052) (Sims-ISWS)
W79-06055

DRILL STEM TESTING AND SAMPLING OF GEO-PRESSURED BRINES,
Halliburton Services, Duncan, OK.
A. G. Edwards, and J. M. Montgomery.
In: Proceedings of the First Workshop On Sampling Geothermal Effluents; Workshop held October 20-21, 1975, Las Vegas, Nevada. Report EPA-600/9-76-011, p 97-113, May 1976. 5 fig, 6 ref.

Descriptors: *Geothermal studies, *Thermal water, *Drilling samples, *Pressure, Drilling, Wells, Sampling, Geology, Transmissivity, Groundwater, Brines, Equipment, On-site investigations, On-site data collections, Drill stem testing.

Technology and equipment are available today for obtaining samples and reservoir data on geo-pressured and most geothermal wells. The ultra-deep search for hydrocarbons has fostered development of subsurface equipment capable of withstanding pressure differentials of 10,000 psi at 500 F. This equipment has been used successfully in a limited number of geothermal wells, but the equipment has seen wide uses in the oil field. In addition to obtaining samples of the formation effluents, the following formation characteristics can be calculated: static reservoir pressure, indicated flow capacity, transmissibility, average effective permeability, damage ratio theoretical potential with damage removed, and the approximate radius of investigation. (See also W79-06052) (Sims-ISWS)
W79-06056

THE SALINITY PROFILE OF THE EAST MESA FIELD AS DETERMINED FROM DUAL INDUCTION RESISTIVITY AND SP LOGS,
Bureau of Reclamation, Boulder City, NV. Region 3.
For primary bibliographic entry see Field 2F.
W79-06057

FIELD SAMPLING OF RADIOACTIVE GEOTHERMAL EFFLUENTS,
LFE Environmental Analysis Labs., Richmond, CA.
For primary bibliographic entry see Field 2F.
W79-06058

UNION OIL COMPANY OF CALIFORNIA'S GEOTHERMAL SAMPLING TECHNIQUES,
Union Oil Co. of California, Brea.
For primary bibliographic entry see Field 2F.
W79-06061

SAMPLING A TWO-PHASE GEOTHERMAL BRINE FLOW FOR CHEMICAL ANALYSIS,
California Univ., Livermore. Lawrence Livermore Lab.
For primary bibliographic entry see Field 2F.
W79-06062

APPROACHES TO INTERPRETING ENVIRONMENTAL DATA,
Aerojet Nuclear Co., Idaho Falls, ID.
D. E. Michels.
In: Proceedings of the First Workshop On Sampling Geothermal Effluents; Workshop held October 20-21, 1975, Las Vegas, Nevada. Report EPA-600/9-76-011, p 204-217, May 1976. 2 fig, 7 ref.

Descriptors: *Sampling, *Monitoring, *Environment, *Pollutants, Thermal water, Geothermal studies, Spatial distribution, Temporal distribution, Distribution patterns, Path of pollutants, Water pollution, Air pollution, Variability, Analytical techniques, Data collections, Data processing.

In order to establish standard or reference procedures aimed at regulation of geothermal sources, it is necessary first to study the patterns involved. In this way, the standardized parts of a procedure can be well-aimed at particular features which geothermal sources have in common in their own patterns of behavior or patterns of dispersion of their effluents. Comparability must be one of the motives behind setting up standardized procedures. Not all components of individual patterns are equally useful in comparing one geothermal source with another. It is necessary to learn which features are important to the purpose, either academic or regulatory, and then to focus the standardization of sampling toward those features. The interpretation of geothermal data must begin before the samples are taken. (See also W79-06052) (Sims-ISWS)
W79-06063

RADIATIVE PROPERTY MEASUREMENTS FOR SELECTED WATER SUSPENSIONS,
Purdue Univ., Lafayette, IN. Heat Transfer Lab.
F. P. Incropera, and K. G. Privoznik.
Water Resources Research, Vol. 15, No. 1, p 85-89, February 1979. 8 fig, 20 ref. NSF ENG75-17370.

Descriptors: *Light, *Light penetration, *Bodies of water, *Optical properties, Radiation, Waste water, Algae, Opacity, Laboratory tests, Absorption, Suspended solids, Particle size, Water pollution, Water pollution effects, *Radiative properties, Light scattering, Light extinction.

Although transport of the visible component of solar radiation in a water body strongly influences thermal structure and the growth of photosynthetic organisms, little is known about the inherent radiative properties which govern this transport. These properties include the extinction, scattering, and absorption cross sections, as well as the scattering phase function. In this study, systematic property measurements were made for two special cases: the wastewater suspension and the symbiotic algal culture. In both cases, extinction is dominated by scattering processes (rather than by absorption), but cross sections associated with the symbiotic cultures are typically a factor of 6 larger than those associated with the wastewater. In both cases, the scattering phase function is strongly peaked in the forward direction. (Sims-ISWS)
W79-06075

SENSITIVE, SPECIFIC FLUORESCENCE IMMUNOASSAY METHODS FOR DETECTING PESTICIDES AND OTHER ORGANIC ENVIRONMENTAL CONTAMINANTS ARISING FROM BIOLOGICAL OR CHEMICAL SOURCES,
IRT Corp., San Diego, CA.
H. R. Lukens, C. B. Williams, S. A. Levison, and W. B. Dandliker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 031, Price codes: A05 in paper copy, A01 in microfiche. Final Report No. NSF/RA-770472, November 21, 1977. 94 p, 28 fig, 12 tab, 23 ref, 4 append. AEN 74-09725A01.

Descriptors: *Pesticides, *Pollutant identification, *Immunoassay, *Organic pesticides, Organic compounds, Diquat, Hexachlorophene, Diethylstilbesterol, Fluorescence, Analytical techniques, Environmental effects.

An immunoassay is described which has been successfully applied in detecting three contaminants of current concern: diquat, hexachlorophene, and diethylstilbesterol. The early stages of the development of a portable fluorescence polarimeter are described. The basic technique in the immunoassay involves the use of an antibody to the specific contaminant, followed by contaminant detection with fluorescence polarization or intensity measurements. The use of ionizing radiation for developing complex conjugate antigens is examined. Not previously reported, this technique significantly reduces the cost of producing these complex conjugates compared to conventional chemical synthesis techniques. (Davison-IPA)
W79-06105

BIOCHEMICAL OXYGEN DEMAND MEASURING DEVICE,
A. R. F. Products Inc., Raton, NM.
L. G. Stolarczyk.
United States Patent No. 4,105,523. Issued August 8, 1978, 9 p. 7 claims. 3 fig.

Descriptors: *Patents, *Biochemical oxygen demand, *Instrumentation, *Water analysis, Testing, Sampling, Water properties, Water pollution, Oxygen, Electrolysis.

The sample to be tested is placed in a sealed reaction chamber large enough to provide an air space above the sample. An oxygen generator including an electrolytic cell is placed in communication with the reaction chamber. The pressure in the air space in the chamber is sensed and the sensing is used to actuate a switch to supply electric current to the electrolytic cell. Operation of the cell supplies oxygen to the air space to replace that consumed by the sample, and the resultant rise in pressure deactivates the switch. The current is supplied in the form of uniform pulses; hence the number of pulses supplied to the cell is a measure of the oxygen produced by the cell as well as a measure of the BOD of the sample. (Lynch-IPC)
W79-06116

BOD TEST VARIABLES,
New Brunswick Dept. of Fisheries and Environment, Fredericton. Environment Div.
D. G. Morrissette, and D. S. Mavinic.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 104, No. EE6, p 1213-1222, December, 1978. 3 fig, 12 ref, 4 tab.

Descriptors: *Biochemical oxygen demand, *Water analysis, *Water pollution, Turbulence, Turbidity, Light, Mixing, Testing, On-site tests, Laboratory tests, Water pollution sources, Streams, Natural streams, Surface waters.

It has been reported that the oxidation rate in a natural stream is higher than the rate obtained from the corresponding laboratory BOD test. This study was undertaken to observe the effect of stream conditions, such as turbulence, light, and turbidity, separately and in combinations, on the BOD test, using raw domestic sewage. Mixing was found to increase the 5-day BOD by an average of 15%, while light increased the BOD by only 4%. Turbidity demonstrated an average reduction of about 24% on BOD values. Mixing and turbidity, in combination, reduced the BOD by 28%, turbidity and light by less than 6%, light and turbidity and mixing by 26%, while mixing and light increased the BOD by about 15%. Thus, extrapolation from laboratory to field conditions, from the existing standard BOD test, yields questionable results. Inclusion of the physical characteristics of the stream in the BOD test is a possible approach to obtaining more meaningful results. (Witt-IPC)
W79-06126

DIRECT AND INDIRECT IMMUNOFLUORESCENCE STAINING OF FECAL STREPTOCOCCI FOR RAPID ASSESSMENT OF WATER QUALITY,
Brookhaven National Lab., Upton, NY.
M. T. Pavlova, E. Beauvais, F. T. Brezenski, and

W. Litsky.
Available from the National Technical Information Service, Springfield, VA 22161 as BNL-23328, Price codes: A02 in paper copy, A01 in microfiche. Presented in part at the Third Conference of the Society of Applied Microbiology, Cairo, Egypt, November 4-9, 1975. 22 p, 6 tab, 13 ref.

Descriptors: *Analytical techniques, *Sewage bacteria, *Streptococcus, *Fluorescence, Water pollution, Waste water, Sewage, Laboratory tests, *Water quality.

An attempt was made to develop a rapid test for the identification of fecal streptococci using immunofluorescence (IF) techniques. Using direct and indirect staining methods with pooled conjugates, it was possible to obtain 81% and 96% positive IF reactions, respectively. All IF cross-reactions observed with non-fecal streptococci and staphylococci were eliminated by trypsinization of the smears prior to direct staining. Trypsinization of the smears did not eliminate all IF cross-reactions when indirect staining methods were used. The direct staining method was not as sensitive as the indirect staining method, but it was specific, rapid, simple, economical, and applicable for rapid identification of fecal streptococci. Using IF techniques, fecal streptococci was identified in water and sewage samples within 20 hr. Conventional biochemical and serological tests may take as long as 7 to 14 days. Thus, IF techniques could possibly be automated for use in continuous monitoring systems. (Small-FIRL)
W79-06133

CHRYSOTILE ASBESTOS DILUTION STUDIES,
Ontario Ministry of the Environment, Toronto.
R. B. Hunsinger, and K. J. Roberts.
Technical Report 66. 1977. 10 p, 2 tab, 3 ref. 1 append.

Descriptors: *Asbestos, *Suspended solids, Turbidity, *Polyelectrolytes, Measurement, *Analytical techniques.

The simple dilution of concentrated asbestos suspensions in various distilled water-river water mixtures was studied. Consistently accurate quantitative analysis of chrystotile asbestos particles in the water mixtures was not possible. Generally the counts made after dilution of the concentrated particles ranged from the anticipated concentration to one or two orders of magnitude below that concentration. No correlation was found between the turbidity of the dilution water used and the resultant asbestos counts. The addition of polyelectrolytes to effect peptization prior to dilution led to more consistent asbestos counts after dilution. The use of peptization for the preservation of samples stored for asbestos analysis should be explored. (Small-Firl)
W79-06153

MODELING WATER QUALITY IN RIVER BASINS,
Kharkov Vodokanalniiproekt Inst. (USSR).
Ye. V. Yeremenko.
In: American Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Kharkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 55-89, September 1978. EPA-600/9-78-024. 11 fig, 17 ref.

Descriptors: *Water quality, *River basins, *Mathematical models, *Pollutants, *Evaluation, *Management, Channels, Algorithms, Hydraulics, Equations, Systems analysis, Diffusion zone, Three-dimensional problems, One-dimensional problems.

The appropriateness of specific waters for particular uses is determined by the combination of physical, chemical, and biologic criteria. However, current mathematical models of water quality use mainly physical criteria. The bases for mathematical models are hydrodynamic or hydraulic equations, and the turbulent diffusion equations for calculating pollutant concentrations with some allowance for nonconservative properties. Depending on whether the size of a river basin section or the whole river basin is considered, different data needs on pollutant concentration in the river are required. If a long stretch of watercourse is considered, it is expedient to use one-dimensional solutions; otherwise a two- or three-dimensional solution should be utilized. The zone within which the pollutant concentration is not completely mixed in the cross-section is called the three-dimensional diffusion zone. Considered is the calculation of the pollutant concentration in this zone. Discussed also are the evaluation of pollution concentration in one-dimensional problems and the solution of some problems of water quality management. (See also W79-06166) (Bell-Graf--Cornell)
W79-06169

MANAGEMENT DECISIONS FOR LAKE SYSTEMS BASED ON A SURVEY OF TROPHIC STATUS, LIMITING NUTRIENTS, AND NUTRIENT LOADINGS,
Corvallis Environmental Research Lab., OR.
A. F. Bartsch, and J. H. Gakstatter.
In: American-Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Karkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 372-394 (Discussion p 395-396), September 1978. 9 fig, 3 tab, 20 ref. EPA-600/9-78-024.

Descriptors: *Lakes, *Management, *Trophic level, *Model studies, *Nutrients, Decision making, Surveys, Eutrophication, Water quality, Reservoirs, Phosphorus, Northeast US, Watersheds(Basins), Algal assay, Vollenweider model, Ontario(Can).

The broad objectives of the National Eutrophication Survey, started in 1972 by EPA, were to identify lakes and reservoirs which receive effluents from municipal sewage treatment facilities and to determine the significance of these point-source nutrient inputs through field investigation. These goals have since been modified to include the relationships between drainage area characteristics and nutrient runoff to develop water quality criteria for nutrients. 812 water bodies distributed across the country were selected for a continuing study. For each lake, information has been sought for making management decisions for control of point and nonpoint sources of phosphorus and other nutrients. The existing trophic conditions were evaluated by sampling and an algal assay was performed to determine whether or not phosphorus, nitrogen, or other elements limited the productivity of the system; used where UH-1H Bell helicopters. Herein, three general models from the literature have been presented which relate total phosphorus to lake response. (See also W79-06166) (Bell Graf-Cornell)
W79-06181

DESCRIPTIVE SIMULATION MODEL FOR FORECASTING THE CONDITION OF A WATER ECOSYSTEM,
Scientific Research Institute of Engineering and Applied Mathematics, Rostov-na-Donu (USSR).
A. B. Gorstko.
In: American-Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Karkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 433--439 (Discussion p 440-441), September 1978. 2 fig. EPA-600/9-78-024.

Descriptors: *Ecosystems, *Water quality, *Simulation analysis, *Model studies, *Azov Sea(USSR), Effects, Computers, Biomass, Algorithms, Forecasting, Equations, Systems analysis.

Sophisticated computers are needed to forecast effects of human activity on aqueous ecological systems. Development of a mathematical model depends upon information available on processes occurring within the ecosystem being studied; model selection is based on the volume of accumulated information. For unique water bodies where the ecosystem has been studied for dozens of years, the best model is the so-called descriptive simulation system. Any acceptable model for forecasting must fulfill five requirements. As an example, the simulation model of the Azov Sea, developed at the Scientific Research Institute of Mechanics and Applied Mathematics, is described herein. The Azov Sea is subdivided into seven segments; the ecosystem in each segment is described by a state vector, the components of which are concentrations of different substances in water and the biomass of specific animals and plants. The most acceptable verification and model refinement can be achieved by testing the algorithm with real data. The basic concepts herein will be used to simulate Lake Baikal. (See also W79-06166) (Bell-Graf--Cornell)
W79-06183

MATHEMATICAL ECOSYSTEM MODELS AND DESCRIPTION OF THE WATER QUALITY IN WATER BODIES,
R. A. Poluektov.
In: American-Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Karkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 442-450, September 1978. 4 fig, 8 ref. EPA-600/9-78-024.

Descriptors: *Water bodies, *Water quality, *Ecosystems, *Model studies, Effects, Behavior, Equations, Simulation analysis, Systems analysis, Methodology, Water biogenosis.

It is essential to construct quantitative models to reflect the behavior of existing natural systems and to forecast the impact of man's controlling actions on these systems. So far in ecosystem modeling, the problem of the specific processes of interactions among different biological species and environmental factors has not been considered. In the work reported herein, the possible outputs from specially constructed systems of differential equations were studied on a comparatively abstract level. The biological interpretation of results reflects subjective views of the investigator rather than the existing situation. Summarized is the general outline of a needed common-point-of-view approach for describing ecosystems. Discussed are principles of ecosystem modeling and modeling methods. Considered are models of interseasonal dynamics of water ecosystems, a model of seasonal dynamics of water ecosystems, and a model of diurnal activity. These dynamic models of water biogenosis can be examined as a hierarchical system of models. (See also W79-06166) (Bell Graf-Cornell)
W79-06184

ACUTE TOXICITY OF COPPER TO SOME FISHES IN HIGH ALKALINITY WATER,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 5C.
W79-06235

ORGANIC MATTER IN SURFICIAL SEDIMENTS OF THE MIRAMICHI ESTUARY, NEW BRUNSWICK, CANADA,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Environmental Marine Geology.
For primary bibliographic entry see Field 2L.
W79-06240

MODE OF ELEMENTAL DISSIPATION FROM ASH BASIN EFFLUENT,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
D. S. Cherry, and R. K. Guthrie.
Water, Air, and Soil Pollution, Vol 9, No 4, p 403-412, May 1978. 3 fig, 4 tab, 11 ref. AEC AT(38-1)-824.

Descriptors: *Fly ash, *Chemicals, *Water pollution, On-site investigations, On-site data collec-

tions, Chemical analysis, Neutron activation analysis, Elements(Chemicals), Pollutants, Pollutant identification, Path of pollutants, Effluents, Biology, Biota, Benthos, Sediments, Water quality, Pollutant dissipation.

The dissipation of chemical elements from ash basin effluent was determined by use of neutron activation analysis of sediment, water, plant, invertebrate, and vertebrate samples taken from successive sites through the drainage system. Samples were tested for concentrations of 40 elements for a 12 month period. Three different modes of dissipation were found. The major mechanism for removal of chemical elements from effluent was sedimentation into the benthic sediment. All biota had greater concentrations of chemicals than did water, with invertebrates having slightly higher levels than did plants and vertebrates. Ten elements were more concentrated in at least one biotic group than in the sediment. Concentrations of 6 elements in the drainage system exceeded the EPA recommended limits for surface waters. The observed modes of dissipation in this aquatic system emphasize the necessity for stable biotic communities present to permit cycling of chemical elements. (Sims-ISWS)
W79-06265

VIRAL AND BACTERIAL AEROSOLS AT A WASTEWATER SPRAY IRRIGATION SITE,
Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
For primary bibliographic entry see Field 5D.
W79-06385

IMPACT OF A SKI BASIN ON A MOUNTAIN WATERSHED, I. BACTERIOLOGICAL WATER QUALITY,
New Mexico Univ., Albuquerque. Dept. of Biology.
C. S. White, J. R. Gosz, and D. I. Moore.
Water, Air, and Soil Pollution, Vol 10, No 1, p 71-79, July 1978. 2 fig, 5 tab, 8 ref.

Descriptors: *Water quality, *New Mexico, *Watersheds(Basins), *Mountains, *Skiing, Coliforms, Streptococcus, Bacteria, Water pollution, Water pollution sources, Land use, Sewage treatment, Septic tanks, Salts, Recreation, Recreation facilities, Recreation wastes, Effects, Potable water, Sampling, Analysis, *Santa Fe(NM), Ski basin impact.

Stream samples were taken at 1 control area above and 2 areas below the Santa Fe Ski Basin. Samples were analyzed for total coliform, fecal coliform, and fecal streptococci. The average ratio of fecal coliform to fecal streptococci below the ski basin was actually lower than the average ratio at the control site. The lower ratio indicates no further contamination from human sources below the ski basin. The coliform colonies isolated were probably from mammals other than human or from human sources other than the sewage disposal system at the ski basin. The few colonies isolated from the stream indicate that the water is not potable during certain seasons. (See also W79-06391) (Sims-ISWS)
W79-06390

IMPACT OF A SKI BASIN ON A MOUNTAIN WATERSHED, II. HEAVY METALS,
New Mexico Univ., Albuquerque. Dept. of Biology.
D. I. Moore, J. R. Gosz, and C. S. White.
Water, Air, and Soil Pollution, Vol 10, No 1, p 81-93, July 1978. 7 tab, 16 ref.

Descriptors: *Water quality, *Watersheds(Basins), *Mountains, *Heavy metals, Skiing, Recreation facilities, Streams, Snowpacks, Lichens, Sampling, Chemical analysis, Pollutant identification, Chemicals, Metals, Pollutants, Water pollution, Water pollution sources, Path of pollutants, Ski basin impacts, Automobile exhaust.

The input of heavy metals by automobile exhaust pollution associated with the ski basin activities was the primary concern of this paper. Stream, snowpack, and lichen samples were collected and analyzed for Pb, Zn, and Cu. Some lichen samples were also analyzed for Ca, Mg, Na, K, Fe, and Mn, as well as Pb, Zn, and Cu. Snowpack samples from roadside areas demonstrated increased levels of Pb and Cu in comparison to areas up to 180 m from the road, but heavy metal levels at more remote areas were comparable to roadside levels. In all snow samples, the heavy metals associated with the particulate matter were the major form of all inputs. Heavy metals in streams were also highly correlated with the particulate matter content. Heavy metal inputs to the watershed were greater than stream export, indicating an accumulation of heavy metals by the system. The forest canopy appears to be the major factor in the accumulation of heavy metals, probably due to better interception and impaction of the particulate matter by the canopy. (See also W79-06390) (Sims-ISWS)
W79-06391

POLLUTION PROFILE OF A RIVER,
Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.
A. C. Paul, and K. C. Pillai.
Water, Air, and Soil Pollution, Vol 10, No 2, p 133-146, August 1978. 6 fig, 7 tab, 9 ref.

Descriptors: *Water pollution, *Pollutants, *On-site investigations, *Pollutant identification, Rivers, Sediments, Sediment transport, Path of pollutants, Water pollution sources, Industries, Effluents, Chemicals, Metals, Chlorides, Fertilizers, Nutrients, Radioactive wastes, Chemical analysis, Sampling, *Periyar River(India), *India.

A host of chemical industries subject the Periyar River, India, to pollutants such as acids, alkalies, and their salts and trace metals and radionuclides belonging to the Th and U chains. Proximity of different outfalls and poor lateral mixing in the river are responsible for high local aquatic concentrations. Scavenging reactions, in situ, and sedimentation of suspended matter result in the accumulation of radionuclides near the outfall area. Monsoons 'flush out' the river into the backwater area, and translocation of sediments is the major factor in the transport of pollutants. (Sims-ISWS)
W79-06397

VARIATIONS IN THE ACID CONTENT OF RAIN WATER IN THE COURSE OF A SINGLE PRECIPITATION,
Arizona Univ., Tucson. Dept. of Chemistry.
For primary bibliographic entry see Field 2K.
W79-06398

IMPACT OF MAN'S ACTIVITIES ON THE CHEMICAL COMPOSITION OF THE SEDIMENTS OF LAKES SUPERIOR AND HURON,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5B.
W79-06399

CONCEPTUAL FRAMEWORK FOR COORDINATED GREAT LAKES MONITORING,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2H.
W79-06402

VIRGIN RIVER STUDY--UTAH: MARCH, 1976,
Environmental Protection Agency, Denver, CO. Surveillance and Analysis Div.
R. L. Fox, and R. M. Eddy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 136, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-908/2-77-005, December 1977. 104 p, 20 fig, 9 tab, 17 ref, 1 append.

Descriptors: *Water quality, *Monitoring, *Sampling, *Water quality standards, *Utah, Rivers, Sediments, Suspended solids, Turbidity, Water chemistry, Chemicals, Pollutants, Pollutant identification, Water pollution, Water pollution sources, Biology, Biological properties, Benthos, Benthic fauna, Water temperature, Streamflow, Hydrogen ion concentration, *Virgin River(Utah).

The Technical Investigations Branch of the Environmental Protection Agency, Region VIII, conducted an intensive water quality study in the Virgin River and Kanab Creek drainages in southwestern Utah in March, 1976. The study was requested by the Five County Association of Governments, the local '208' water quality management planning agency. Water, sediment, and benthic samples were collected at selected locations throughout a total stream reach of 174 km. Study results indicated a gradual degradation of water quality downstream from Zion National Park. Violations of recommended criteria/standard levels were most common for the salinity parameters, but concentrations of arsenic, iron, manganese, and mercury also exceeded recommended levels. In addition, high concentrations of suspended solids impaired the quality of water throughout much of the study area. (Sims-ISWS)
W79-06423

A SUMMARY OF KNOWLEDGE OF THE SOUTHERN CALIFORNIA COASTAL ZONE AND OFFSHORE AREAS. VOL. I - PHYSICAL ENVIRONMENT; VOL II - BIOLOGICAL ENVIRONMENT; VOL III - SOCIAL AND ECONOMIC ELEMENTS.
Southern California Ocean Studies Consortium, California State University and Colleges Long Beach, California. Dailey, M.D.; Hill, B.; and Lansing, N. (Eds.). September, 1974. BLM-08550-CT4-1.

Descriptors: *Baseline studies, *Resources development, *Environmental effects, *Water pollution sources, *Water pollution effects, Geology, Climatology, Oceanography, Oil pollution, Heavy metals, Thermal pollution, Biota, Economics, Social aspects, *Outer Continental Shelf, *Environmental impact, Southern California Bight.

A report which offers a description of the economic and physical forces, and biological and social resources existing in the Southern California Continental Borderland Area provides the basis for analyzing the feasibility of offering some of the Area for future mineral development, and assessing the environmental impacts that might result from a proposed leasing action. The subject matter has been grouped into three volumes which reflect the major disciplines as examined: I. Physical Environment; II. Biological Environment; III. Social and Economic Elements. Each volume includes a master bibliography for its contents. Each of the twenty-two separate chapters is essentially self-contained and intended to stand alone as a summary of the available knowledge in that subject. (See W79-06450 thru W79-06463) (Sinha-OEIS)
W79-06449

5B. Sources Of Pollution

NATURAL DISTRIBUTION AND ENVIRONMENTAL BACKGROUND OF TRACE HEAVY METALS IN ALASKAN SHELF AND ESTUARINE AREAS,
Alaska Univ., Fairbanks. Inst. of Marine Science.
D. C. Burrell.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol VIII, Contaminant Baselines, p 199-494, October 1978. 44 fig, 59 tab, 12 ref, 6 append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-56.

Descriptors: *Baseline studies, *Heavy metals, *Sediments, *Bacteria, *Benthos, Water pollution sources, *Cadmium, Biota, Toxicity, Coasts, Estuaries, Shellfish, Mammals, Selenium, Manganese, Nickel, Alaska, *Outer Continental Shelf.

The data indicate that the sediments, water and indigenous biota of the Alaskan shelf and coastal waters have heavy metal contents which are as low or lower than those recorded elsewhere for similar unpolluted oceanographic environments in more temperate regions. The sediments contain concentrations of extractable trace metals which are a function of the grain size distribution, for example and, as would be expected, no unnatural enrichments have been recorded. Similarly, the means for the soluble contents of metals in the water column correspond to those recorded for open ocean areas anywhere. Enhanced values adjacent to the bottom were commonly observed; this is here likely to be due to the incorporation of fine grained particulate and colloidal material rather than, say, regeneration of metals from biota debris but is, in either case, a natural feature. The most comprehensive set of data are for marine mammals from the Bering Sea. Relatively enhanced values for toxic metals such as cadmium in kidney and liver samples are recorded. A major effort has been concerned with the uptake of heavy metals by natural marine sediment bacteria populations and transfer to the deposit feeding benthos. Initial results show that cultured heterogenous marine bacteria strongly concentrate cadmium and that, when used as a food source by detritivore clams, they later show elevated (though not magnified) concentrations. (Sinha-OEIS)
W79-06024

HYDROCARBONS: NATURAL DISTRIBUTION AND DYNAMICS ON THE ALASKAN OUTER CONTINENTAL SHELF,
Alaska Univ., Fairbanks. Inst. of Marine Science.
For primary bibliographic entry see Field 5C.
W79-06025

CHARACTERIZATION OF ORGANIC MATTER IN SEDIMENTS FROM LOWER COOK INLET,
California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
S. Brenner, I. R. Kaplan, M. I. Venkatesan, J. Bonilla, and E. Ruth.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol VIII, Contaminant Baselines, p 589-621, October 1978. 4 fig, 7 tab, 13 ref. NOAA, Outer Continental Shelf Environmental Assesment Program, Boulder, Colorado. 03-6-022-35250.

Descriptors: *Analysis, *Organic matter, *Baseline studies, *Sediments, *Water pollution sources, Paths of pollutants, Oil pollution, Environmental effects, Resources development, Alaska, *Outer Continental Shelf, *Petroleum hydrocarbons, *Biogenic hydrocarbons.

A large portion of the effort in the past contract year has been devoted to the development of reliable extraction and analysis procedures. Satisfactory analysis of sediment samples containing even every small amounts of organic components can now be performed. All Lower Cook Inlet samples from 1976-1977 cruises have been analyzed and the data processed. Analyses of samples from the other regions of Alaska OCS is nearly complete as well. Each sample was analyzed for: (1) total carbon content, (2) organic carbon content, (3) sulfur content, (4) aliphatic hydrocarbons, and (5) aromatic hydrocarbons. No signs of petroleum hydrocarbons input were detected, hence the organic content of the sediments is biogenic, derived from terrestrial and marine sources. Since it was possible to distinguish between marine and terrestrial sources of hydrocarbons, this information should allow the prediction of the fate of petroleum introduced into Lower Cook Inlet through routine activity or through accidental spillage. (Sinha-OEIS)
W79-06026

LONGITUDINAL DISPERSION WITH NON-LINEAR ADSORPTION IN POROUS MEDIA,
Maryland Univ., College Park. Water Resources Research Center.
T. Tagamets.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 578, Price codes: A06 in paper copy, A01 in microfiche. Technical Report No 52(6), (1973), 93 p, 15 fig, 45 ref, 2 append. OWRT A-023-MD(2). 14-31-0001-5020.

Descriptors: Ground water, Adsorption, Pollutant removal, Longitudinal dispersion, Porus media, *Path of pollutants, *Groundwater, Pollutant dispersion, Soil water movement.

Evaluation and quality control of ground water requires a better understanding of the physicochemical processes that determine the degree of retention or movement of pollutants in ground water. The distance that a polluting substance moves in soil depends on physical and chemical parameters. The physical parameter can be described as a transport step and the chemical parameter as an attachment step. To predict movement of a pollutant through soil requires that both parameters be incorporated in a predictive model. The adsorption of many solutes on activated charcoal and soils follow a non-linear rather than a linear isotherm. A one-dimensional dispersion equation subject to a non-linear isotherm has been formulated and solved using a finite difference scheme. A comparison between the theoretical results and some experimental data is presented.
W79-06027

PROCEEDINGS OF THE FIRST WORKSHOP ON SAMPLING GEOTHERMAL EFFLUENTS.
For primary bibliographic entry see Field 2F.
W79-06052

GEOTHERMAL ENERGY DEVELOPMENT,
Stanford Univ., CA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W79-06053

GEOTHERMAL EFFLUENTS, THEIR TOXICITY AND PRIORITIZATION,
Woodward-Clyde Consultants, San Francisco, CA.
L. Schieler.
In: Proceedings of the First Workshop On Sampling Geothermal Effluents; Workshop held October 20-21, 1975, Las Vegas, Nevada. Report EPA-600/9-76-011, p 36-66, May 1976. 12 tab, 11 ref.

Descriptors: *Geothermal studies, *Thermal water, *Pollutants, *Toxins, Hydrogen sulfide, Ammonia, Chemicals, Salts, Gases, Radioisotopes, Radioactive wastes, Water pollution, Water pollution sources, Effluents, Hazards, Groundwater.

Exploitation of geothermal resources is hampered by a lack of understanding of the basic chemical interactions and toxicity hazards associated with the gaseous and aqueous effluents characteristic of various geothermal areas. The objective of this paper was the evaluation of the relative hazards of the various effluents in both liquid- and vapor-dominated fields in terms of concentration and chemical toxicity effects. Many chemical species must be considered in evaluating liquid-dominated systems, but only a few volatile species are significant in vapor-dominated systems. This is a direct consequence of the thermodynamic equilibria established among the chemical elements over the wide range of temperatures encountered in various geothermal areas. Vapor-dominated systems are lacking the aqueous phase required for dissolving water soluble salts. Since water is present as steam rather than as liquid, vapor-dominated systems tend to be lower in total dissolved solids than liquid-dominated systems. Volatility is the primary transport mechanism in vapor-dominated systems. (See also W79-06052) (Sims-ISWS)
W79-06054

APPROACHES TO INTERPRETING ENVIRONMENTAL DATA,
Aerojet Nuclear Co., Idaho Falls, ID.
For primary bibliographic entry see Field 5A.
W79-06063

DISPERSION OF SOLUBLE POLLUTANTS IN NON-UNIFORM RIVERS, I. THEORY,
Commonwealth Scientific and Industrial Research Organization, North Ryde (Australia).
B. M. Chapman.
Journal of Hydrology, Vol. 40, No. 1/2, p 139-152, January 1979. 6 fig, 7 ref.

Descriptors: *Dispersion, *Pollutants, *Rivers, *Model studies, Mathematical models, Theoretical analysis, Equations, Non-uniform flow, Mixing, Velocity, Diffusion, Convection, Path of pollutants, Water pollution, Flow, Hydrology, Soluble pollutants.

An analytical framework was developed to represent the solute dispersion behavior of a river whose local average velocity, flow rate, and dispersion characteristics vary along its length. A coordinate transformation through which the concept of a dispersion coefficient was replaced by that of a characteristic time allows the use of dimensionless equations. By measuring concentration-time profiles at various stations downstream from a point where a slug of pollutant is instantaneously released, it was possible to determine the variation of the characteristic time of the river along its length. (See also W79-06066) (Sims-ISWS)
W79-06065

DISPERSION OF SOLUBLE POLLUTANTS IN NON-UNIFORM RIVERS, II. APPLICATION TO EXPERIMENTAL RESULTS,
Commonwealth Scientific and Industrial Research Organization, North Ryde, (Australia).
B. M. Chapman.
Journal of Hydrology, Vol. 40, No. 1/2, p 153-163, January 1979. 9 fig, 1 tab, 4 ref.

Descriptors: *Dispersion, *Pollutants, *Rivers, *Model studies, Mathematical models, Theoretical analysis, Equations, On-site investigations, Dye releases, Nonuniform flow, Mixing, Diffusion, Velocity, Path of pollutants, Water pollution, Flow, Hydrology, Soluble pollutants.

The use of the theory of dispersion in non-uniform rivers, presented in Part I of this series, was demonstrated using 2 sets of previously published experimental results. The first set of data was obtained at 2 downstream stations following an accidental spill of chloroform in the Mississippi River. The second set of data involved the measurement of concentration-time profiles following the intentional release of soluble dye in a creek. Very satisfactory fits of the data with the theory were obtained in both cases. A final example illustrated how a general concentration-time profile obtained at one station may be used to predict the profile when it reaches a second station further downstream. All calculations were carried out on a programmable pocket calculator. (See also W79-06065) (Sims-ISWS)
W79-06066

EVOLUTION OF CONTAMINATED GROUNDWATER IN HOLT COUNTY, NEBRASKA,
Nebraska Univ., Lincoln. Conservation and Survey Div.
M. E. Exner, and R. F. Spalding.
Water Resources Research, Vol. 15, No. 1, p 139-147, February 1979. 3 fig, 6 tab, 36 ref.

Descriptors: *Water pollution, *Nebraska, *Groundwater, *Correlation analysis, Water pollution sources, Fertilizers, Statistical models, Irrigation, Sampling, Water analysis, On-site data collections, Sands, Agriculture, Graphical analysis, Water quality, Nitrates, Model studies, *Holt County(NB), Vertical permeability, Nonpoint-source pollution, Point-source pollution.

The theoretical absence of the in situ formation of most common mineral phases and the high vertical permeability of the relatively inert soils and unsaturated layer permit detection of man-induced environmental changes in the dilute groundwater of Holt County. Correlation coefficients show many significant associations for the major ions in groundwater affected by point and nonpoint-

source contamination. Large areas of nonpoint contamination are attributed to fertilization and irrigation of the sandy soils. In these areas, increases in the average annual groundwater concentrations of Cl(-), SO4(2-), and NO3(-) average 0.44, 0.57, and 4.9 mg/l/yr, respectively. A proposed model suggests that 50% of the applied nitrogen fertilizer infiltrates to the groundwater reservoir. (Visocky-ISWS)
W79-06071

SYMPOSIUM ON ENVIRONMENTAL TRANSPORT AND TRANSFORMATION OF PESTICIDES: JOINT U.S.--U.S.S.R PROJECT 02.03-31, 'FORMS AND MECHANISMS BY WHICH PESTICIDES AND CHEMICALS ARE TRANSPORTED'.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 714, Price codes: A11 in paper copy, A01 in microfiche. Report No EPA-600/9-78-003, February 1978. Symposium held in Tbilisi, USSR, October 20-27, 1976, 252 p, 62 fig, 29 tab, 399 ref. Environmental Research Laboratory, Athens, GA.

Descriptors: *Pesticide kinetics, *Pesticide residues, *Pesticide drift, *Pesticides, Movement, Path of pollutants, Soil water, Translocation, Pollutants, Chemical wastes, Soil contamination, Water pollution, Mathematical models, Absorption, Adsorption, Distribution patterns, Volatility, Persistance, Animal metabolism, Agricultural chemicals, Environmental impact.

The extended abstracts of 26 papers presented on the movement and transformations of pesticides in the atmosphere, in soils, in water, in plants, and in animals are compiled. The use of mathematical modeling to describe the transport and transformation of pesticides in the environment is reported. The state of the art in each country and results of research on particular aspects of the topic are presented. (Davison-IPA)
W79-06098

PHOSPHORUS INTERACTIONS IN THE AQUATIC ENVIRONMENT: A SURVEY OF THE LITERATURE,
Vermont Univ., Burlington. Water Resources Research Center.
D. W. Meals, Jr., and E. A. Cassell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 418, Price codes: A06 in paper copy, A01 in microfiche. Lake Champlain Basin Study, New England River Basins Commission, Burlington, Vermont, February, 1978. 104 p, 25 fig, 10 tab, 127 ref. OWRT A-036-VT(1).

Descriptors: *Phosphorus, *Aquatic plants, *Wetlands, Lakes, Streams, Marsh plants, Absorption, Sediments, Bibliographies.

The mechanisms by which phosphorus is retained in wetlands are: physical entrapment of particulate phosphorus, chemical sorption of P by organic matter and soil materials, and biological utilization of P by microorganisms and macrophytes. Many rooted aquatic plants are highly effective in removing phosphorus from water and are even capable of storing excess phosphorus in their tissues. Some wetland vegetation act to pump phosphorus from the sediments to the water through release of phosphorus from leaf tissue. Rapid decomposition of wetland plants may also release phosphorus to water. In streams, there are relationships between P concentration and stream flow. These are: the dilution effect, an inverse correlation between stream flow and concentration caused by dilution of point source P inputs by stream flow; and the runoff effect, P concentration increase with increasing stream flow caused by contribution of P from land runoff during high flow. Adsorption by sediments and biological uptake by periphyton are the most important mechanisms for P removal. Lake sediments typically contain very large quantities of P, frequently exceeding the total mass of P present in the lake water. Phosphorus tends to be adsorbed by sediment materials under aerobic conditions and desorbed under anaerobic conditions. (Steiner-Mass)
W79-06109

GREAT LAKES WATER QUALITY SIXTH ANNUAL REPORT. APPENDEX F. REPORT ON HAZARDOUS WASTE DISPOSAL.
International Joint Commission-United States and Canada, Windsor (Ontario). Great Lakes Water Quality Board.
1978. 34 p, 2 append.

Descriptors: *Great Lakes region, *Hazards, Toxins, *Industrial wastes, Water pollution, Waste water treatment, *Liquid wastes, Energy, Waste disposal, Regulation.

Problems generated by hazardous waste disposal in the Great Lakes Drainage Basin are reviewed. Although reasonable treatment techniques exist, current liquid industrial waste management does not sufficiently considered waste characteristics, environmental hazards, long term effects, or possible benefits from reclamation of recoverable energy components of wastes. Possible treatment techniques are reviewed. The Water Quality Board recommends the development of compatible programs and regulations for the managment of hazardous wastes be developed and enforced. These programs should be national in scope. (Small-FIRL)
W79-06110

MATHEMATICAL MODELING OF THE HYDRODYNAMICS AND DISPERSION OF CONTAMINANTS IN THE NEARSHORE,
Case Western Reserve Univ., Cleveland, OH. Dept. of Geology.
W. Lick.
In: American-Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Karkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 282-312 (Discussion p 313-315), September 1978. 19 fig, 1 tab, 13 ref. EPA-600/9-78-024.

Descriptors: *Model studies, *Hydrodynamics, *Dispersion, *Contaminants, *Lakes, *Lake Erie, *Water pollution, *Nearshore regions, Numerical analysis, Wind, Lake currents, Depth, Velocity, Powerplants, Discharge(Water), Surface temperature, Bottom topography, Thermal plumes, Equations, Open-lake waters, Prediction, Systems analysis.

Because of possible harmful effects of contaminants, it is necessary to be able to predict their dispersion and fate in large lakes. The nearshore regions of these lakes are especially important; recent studies have demonstrated significant differences between nearshore and open-lake waters. First of all, the nearshore regions are where contaminants are generally introduced; secondly, the nearshore regions are of more interest to use for such uses as recreation, water supplies, and fishing. As part of a research effort sponsored by the U.S. Environmental Protection Agency, numerical models have been developed which can realistically describe the currents and dispersion of contaminants throughout large lakes and especially in the nearshore hydrodynamic and dispersion models, which necessarily include procedures for coupling the nearshore and offshore lake circulations. Specific applications have been made to predict the dispersion of contaminants under specific conditions and to understand the physical consequences. Presented are these specific examples: (1) the wind-driven currents, both open-lake and nearshore, in Lake Erie under steady-state, constant density conditions; (2) the dispersion of a contaminant from a river into Lake Erie by wind-driven currents under present conditions and as modified by proposed large man-made islands such as a jetport in the lake; and (3) the dispersion of heat in the discharge from a power plant on Lake Michigan. Presented are a constant-density, steady-state model and a variable-density, time-dependent model; both are fully three-dimensional and give all three components of velocity at any point in the lake. (See also W79-06166) (Bell Graf-Cornell)
W79-06178

MATHEMATICAL MODELING STRATEGIES APPLIED TO SAGINAW BAY, LAKE HURON,
Environmental Protection Agency, Grosse Ile, MI.
V. Bierman, W. Richardson, and T. T. Davies.
In: American-Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Karkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 397-430, September 1978. 19 fig, 1 tab, 48 ref. EPA-600/9-78-024.

Descriptors: *Model studies, *Lake Huron, *Saginaw Bay, *Simulation analysis, *Water quality, Drainage basins, Runoff, Phytoplankton, Great Lakes, Equations, Systems analysis, Sensitivity analysis, Mass balance.

Described is modeling research to develop quantitative tools which can be used to supplement intuition and scientific judgment in policy decisions concerning water quality. Quality problems concerning the international waters of the Great Lakes and the application of modeling techniques to Saginaw Bay are considered. Problems are categorized into a series of time and space scales. The series ranges from the short-term transport of some hazardous material within a very localized area to the long-term effects of control or limitation of nutrients or toxic materials within the drainage basins on the ecosystem of individual lakes or of the whole system of lakes. This paper attempts to integrate these different approaches. Applied are transport models and algal growth modeling concepts to Saginaw Bay to describe its prevailing conditions. The simulation model developed is based on available data on the bay, and the modeling concepts will be verified by using an extensive set of field data collected from a sampling design aimed specifically at this modeling program. This modeling system will be used to evaluate the response of the system to a range of management alternatives for enhancing water quality. (See also W79-06166) (BellGraf-Cornell)
W79-06182

ORGANIC MATTER IN SURFICIAL SEDIMENTS OF THE MIRAMICHI ESTUARY, NEW BRUNSWICK, CANADA,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Environmental Marine Geology.
For primary bibliographic entry see Field 2L.
W79-06240

MODE OF ELEMENTAL DISSIPATION FROM ASH BASIN EFFLUENT,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
For primary bibliographic entry see Field 5A.
W79-06265

DESIGN MODEL FOR THERMAL EFFLUENTS IN RIVERS,
Italian Electrical Power Agency, Pisa. Thermal and Nuclear Research Centre.
G. Dinelli, and L. Castellano.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY3, Proceedings Paper 14422, p 197-211, March 1979. 8 fig, 20 ref, 2 append.

Descriptors: *Thermal pollution, *Rivers, *Model studies, Mathematical models, Numerical analysis, Effluents, Water pollution, Powerplants, Eddies, Buoyancy, Temperature, Water temperature, Diffusion, Turbulence, Velocity, Viscosity, Path of pollutants, Hydraulics.

A quasi three-dimensional mathematical model describing the thermal impact of warm water discharges in rivers was presented. The governing equations were obtained integrating along the depth the complete set of the Navier-Stokes equations with Leibniz's rule and assuming that buoy-

ancy forces are negligible. After the analytical integration was performed, in the mass, momentum and energy equations, terms appeared that make it possible to account for the effects of the actual geometry of the river's cross section and bottom. The eddy viscosity and thermal diffusivity were taken into account by adopting an algebraic model of turbulence based upon the Prandtl mixing length theory. The numerical model, obtained with a finite difference method, provided the spatial, time-dependent distributions of the velocity and temperature fields. The model's results were satisfactorily checked against field data in the case of thermal discharges into fast moving rivers. (Sims-ISWS)
W79-06267

TRENDS IN SEDIMENTATION,
Geological Survey, Reston, VA. Water Resources Div.; and Geological Survey, Towson, MD. Water Resources Div.
For primary bibliographic entry see Field 2J.
W79-06319

ARSENIC, NITRATE, IRON, AND HARDNESS IN GROUND WATER, FAIRBANKS AREA, ALASKA,
Geological Survey, Anchorage, AL. Water Resources Div.
P. Johnson, D. E. Wilcox, W. D. Morgan, J. Merto, and R. McFadden.
Geological Survey open-file report 78-1034, 1978. 2 sheets, 14 ref.

Descriptors: *Water quality, *Groundwater, *Iron, *Hardness(Water), *Water wells, Water analysis, Chemical analysis, Water pollution, Public health, Maps, Alaska, Fairbanks area.

Well water with concentrations of arsenic and nitrate exceeding U.S. Environmental Protection Agency standards occurs sporadically throughout the hills north of Fairbanks, Alaska. The arsenic contamination has not been correlated with placer or other mining activity. The high levels of nitrate do not generally appear related to septic waste contamination. Few wells in the Fairbanks area yield water with low concentrations of iron or low hardness. Iron concentrations are consistently greater than 3 mg/L on the flood plain. In the uplands, concentrations of both iron and hardness are lowest near the ridgetops and increase downslope. The report includes a map of the area showing the location of sampled wells and a table of chemical analysis. (Woodard-USGS)
W79-06320

ASSESSMENT OF NONPOINT SOURCES AREAWIDE WASTE TREATMENT MANAGEMENT PLAN FOR THE GREATER HOUSTON AREA.
Dannenbaum Engineering Corp., Houston, TX.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 736, Price codes: A17 in paper copy, A01 in microfiche. 1977. 399 p, 18 fig, 57 tab, 120 ref, 2 append.

Descriptors: *Water pollution sources, Texas, Cities, *Urban runoff, *Septic tanks, Water quality, Seepage, *Construction, Dredging, *Biochemical oxygen demand, Mathematical models, Coliforms, Industrial wastes, Pesticides, Oil, Suspended solids.

The nonpoint sources of water pollution within the Greater Houston 208 Planning Area are assessed. Water pollution resulting from urban runoff, septic tank seepages, agricultural runoff, construction site runoff, dredging, and benthal oxygen demand is considered. An analysis of 108 runoff events in several areas of the country, indicated a strong correlation between the log of the cumulative runoff volume and the log of the cumulative pollutant load. Using regression analysis, a stormwater quality-quality model was developed. When septic tank seepages were studied, the Sims Bayou Basin had the greatest pollution impact of septic tanks based on theoretical calculations. Fecal coliforms and BOD were used as septic seepage indicators. The effects of agriculture, injection wells, shipping, oil field waste disposal, and salt water intrusion on water quality were investigated. Mineral and organic suspended sediment in air and water as a result of contruction activities, was emphasized. Other pollutants considered included pesticides, nutrients, solid wastes, construction chemicals, petroleum products, and sanitary wastes. Finally, benthal oxygen demand was a significant sink of dissolved oxygen in the area, particularly in the Houston Ship Channel. (Small-FIRL)
W79-06344

ASSESSING NON-POINT SOURCE POLLUTION. A DETAILED STUDY OF A RURAL WATERSHED IN THE COASTAL PLAIN OF MARYLAND,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
M. Beane, G. R. Chirlin, D. L. Correll, E. S. Friebele, and M. Faust.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 178, Price codes: A04 in paper copy, A01 in microfiche. Report 1977. 59 p, 4 fig, 15 tab, 31 ref, 2 append.

Descriptors: *Surface runoff, *Watersheds(Basins), *Heavy metals, *Nutrients, *Bacteria, *Pesticides, Sediments, Maryland, Water quality, Agricultural runoff, Coliforms, Seasonal, Pastures.

A detailed, non-point source study on a rural watershed in the coastal plain of Maryland is presented as the research has applicability to similar regions of the country. Heavy metals, nutrients, bacteria, and sediment were monitored in surface runoff from the Rhode River. The magnitude of non-point source loading to an estuary from a rural watershed and the impact of this loading on water quality, were determined. Nutrient inputs and outputs were determined for each major land use in the watershed. The average yearly discharge of nitrogen, phosphorus, calcium, and magnesium in runoff was highest for pasture, second highest for cultivated land, and very low for forest. Sediment discharge was highest in summer and increased with volume of discharge. Sixty-eight percent of the fecal coliform bacteria discharged came from pasture, 17% from forest, and 15% from cultivated land. Cultivated land had the highest discharge rate for metals in fall, while in summer, pasture had the highest rate. Fe, Mn, Cr, and possibly Cu, were derived from the soil, while Zn, Pb, and Cd were of man-made origin. Alachlor and atrazine concentrations were monitored. Alachlor did not persist in the soil and only .02% of the amount applied to the land was lost in runoff. Atrazine remained in the soil at significant levels four months after its application. Runoff contained 1.2% of the atrazine. (Small-FIRL)
W79-06353

THE SPREADING, RETENTION AND CLEAN-UP OF OIL SPILLS,
Rhode Island Univ., Kingston. Coll. of Engineering.
M. P. Wilson.
Available from the National Technical Information Service, Springfield, VA 22161 as HCP/P2756-01, Price codes: A07 in paper copy, A01 in microfiche. Report HCP/P2756-01, 1978. 126 p, 5 fig, 14 tab, 387 ref.

Descriptors: *Oils spills, Oil pollution, Water pollution control, *Barriers, *Biodegradation, *Chemical reactions, *Oceans, Dispersion, Dynamics.

The current state-of-the-art for the spreading-retention and clean-up of oil spills is reviewed with in-depth analysis of specific areas not treated in-depth in the literature. Oil spill statistics, tanker and non-tanker ship-generated pollution, and the spreading and drifting of oil slicks are discussed. Containment devices are described. Recommendations are made for basic analytical and experimental studies in barrier technology including fluid dynamics of oil slicks, surface active chemical agents, fast current barrier studies, barrier dynamics, and potential hazards from the use of barriers. Natural and forced biodegradation, and natural and chemical dispersion of oil into the marine environment, are discussed. Research and development needed to mitagate the environmental impact of oil pollution are discussed including preventive techniques, containment, clean-up, and dispersion. (Small-FIRL)
W79-06367

IMPACT OF A SKI BASIN ON A MOUNTAIN WATERSHED, I. BACTERIOLOGICAL WATER QUALITY,
New Mexico Univ., Albuquerque. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W79-06390

IMPACT OF A SKI BASIN ON A MOUNTAIN WATERSHED, II. HEAVY METALS,
New Mexico Univ., Albuquerque. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W79-06391

FINITE-ELEMENT ANALYSIS OF THE TRANSPORT OF WATER AND SOLUTES IN TILE-DRAINED SOILS,
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
For primary bibliographic entry see Field 2F.
W79-06393

POLLUTION PROFILE OF A RIVER,
Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.
For primary bibliographic entry see Field 5A.
W79-06397

IMPACT OF MAN'S ACTIVITIES ON THE CHEMICAL COMPOSITION OF THE SEDIMENTS OF LAKES SUPERIOR AND HURON,
Canada Centre for Inland Waters, Burlington (Ontario).
A. L. W. Kemp, J. D. H. Williams, R. L. Thomas, and M. L. Gregory.
Water, Air, and Soil Pollution, Vol. 10, No. 4, p 381-402, November 1978. 7 fig, 6 tab, 52 ref.

Descriptors: *Sediments, *Pollutants, *Lake Huron, *Lake Superior, *Great Lakes, Sampling, Chemicals, Organic matter, Metals, Heavy metals, Particle size, Hydrogen ion concentration, Oxidation-reduction potential, Water pollution, Water pollution sources, Path of pollutants, Sedimentation.

The concentrations of organic matter, major elements, and trace elements were determined at 15 core locations in Lakes Superior and Huron. The chemical compositions of the cores were related to sediment particle size, Eh, pH, chronology, and location. Concentrations of Si, Al, Ca, Mg, K, Na, and Ti, which represent the major mineral species in the sediments, were generally uniform in each core. Surface enrichments of Hg, Pb, Zn, Cu, Ni, Co, Cd, Cr, Be, V, As, Org-C, and N at many of the locations were attributed to anthropogenic inputs of these elements in recent years. Concentration profiles of Fe, Mn, P, and S are influenced by migration of these elements in the pore waters. High anthropogenic Cu loadings in Lake Superior were related to Cu mining activities in the lake basin, while high anthropogenic inputs of Ni to the Lake Huron sediments were related to Ni contamination from the Sudbury area. Sediment loading calculations showed that the anthropogenic inputs of trace and nutrient elements are related to the sedimentation rate, that the inputs are dispersed over wide areas of the lakes, and that inputs to Lake Superior have increased significantly since 1955. Evidence was presented that atmospheric inputs are an important source of contaminants. (Sims-ISWS)
W79-06399

RATES OF LEACHING OF RADIUM FROM CONTAMINATED SOILS: AN EXPERIMEN-

TAL INVESTIGATION OF RADIUM BEARING SOILS FROM PORT HOPE, ONTARIO,
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
J. S. Nathwani, and C. R. Phillips.
Water, Aid, and Soil Pollution, Vol 9, No 4, p 453-465, May 1978. 5 fig, 4 tab, 6 ref.

Descriptors: *Radium, *Leaching, *Soil contamination, *Laboratory tests, *Canada, Radioactivity, Radioactive wastes, Radioactive waste disposal, Acids, Acidity, Acidic water, Hydrogen ion concentration, Soils, Infiltration, Pollutants, Path of pollutants, Groundwater, Water quality, Water pollution, Water pollution sources.

The leachability of Ra-226 from soil at Port Hope, Ontario, contaminated by waste from a long established U refinery was described. A small-scale static leach test was devised to provide information to permit an assessment of hazard due to leaching in the environment. Two different leaching solutions were prepared to simulate a range of infiltrating water quality in disoposal environments: one by bubbling CO2 into distilled water to pH 5.5, and another by bubbling SO2 into water to pH 3.5. Narrow-range size fractions of the soils (i.e., 0.250 to 0.105 mm) were leached for 30 to 45 days (equivalent rainfall of 2 to 3 yr). It was found that leaching is significantly affected by soil texture, total amounts leached and the maximum concentrations reached being much greater for coarser and intermediate size fractions than for fine soil fractions. Also, leachant acidity significantly increased leaching rates and resulted in enhanced mobility in soils. A straight line for the plot of Q/Q sub o (cumulative fraction released) vs square root of T (T is leaching time in days) indicated that leaching could be considered to be a diffusion phenomenon in accordance with Fick's law. Diffusion coefficients ranging from 5 x 10 to the minus 11th power to 2 x 10 to the minus 13th power sq cm/day were found. These coefficients provide a basis for estimating the fraction that would be leached over longer periods. (Sims-ISWS)
W79-06400

LEACHING OF PHOSPHATE FROM AGRICULTURAL SOILS TO GROUNDWATER,
Connecticut Agricultural Experiment Station, New Haven. Dept. of Soil and Water.
B. L. Sawhney.
Water, Air, and Soil Pollution, Vol 9, No 4, p 499-505, May 1978. 3 fig, 2 tab, 16 ref.

Descriptors: *Leaching, *Phosphates, *Soil water movement, *Groundwater, Phosphorus, Phosphorus compounds, Soil water, Fertilizers, Sewage sludge, Agriculture, Crops, Pollutants, Path of pollutants, Vegetation effects, Water pollution, Water pollution sources, Water quality.

To examine the fate of P added to soils as fertilizer and to assess potential P losses to groundwater, different forms of P at increasing depths in soils and P concentration in effluents from tile drains were determined. The estimates of soil P showed that the fertilizer P applied over a number of years accumulated mainly in the plow layer, suggesting that P losses to groundwater from cultivated soils with deep water table are minimum. Analyses of effluents obtained over a 1 yr period from tile drains in 4 soils in different crops, however, showed that the concentration of P varied from 12 ppb to 124 ppb. The concentration of P in effluent from the soil with the largest amount of P in the plow layer remained the largest throughout the year. Apparently, in cultivated soils with the tile drains, flooding may produce reducing conditions resulting in greater mobility of P. (Sims-ISWS)
W79-06401

FIELD PROCEDURES AND EVALUATION OF A SLUG DILUTION GAUGING METHOD IN MOUNTAIN STREAMS,
Geological Survey of Canada, Ottawa (Ontario).
T. J. Day.
Journal of Hydrology (New Zealand), Vol 16, No 2, p 113-115, 1977. 8 fig, 8 tab, 20 ref.

Descriptors: *Mixing, *Waste dilution, *Streams, *Tracers, Stream flow, Turbulence, Channels, Mountains, On-site investigations, On-site data collections, Data processing, Equipment, Instrumentation, Sampling, Salts, Sodium chloride, Hydraulics, Hydrology, *New Zealand.

The application of a method (NaCl) of dilution gaging in turbulent mountain streams was evaluated with discussions about equipment, field procedures, mixing lengths, tracer losses, and the precision of derived hydraulic parameters. Mixing lengths were shown to be equal to 25 mean channel widths, and that this length was independent of the cross-sectional position of injection. Tracer losses were described as linear features, although no explanation can be offered. Precision, expressed as percentage probable error about the means of the 4 pertinent hydraulic variables, was discussed, with individual errors ranging from 1 to 21%, median errors ranging from 4.7 to 7.3% and modal errors ranging from 3.6 to 6%. Comments on sampling procedures were offered, and several simplified procedures for estimating the mean velocity and discharge were presented. (Sims-ISWS)
W79-06415

VIRGIN RIVER STUDY--UTAH: MARCH, 1976,
Environmental Protection Agency, Denver, CO. Surveillance and Analysis Div.
For primary bibliographic entry see Field 5A.
W79-06423

A SUMMARY OF KNOWLEDGE OF THE SOUTHERN CALIFORNIA COASTAL ZONE AND OFFSHORE AREAS. VOL. I - PHYSICAL ENVIRONMENT; VOL II - BIOLOGICAL ENVIRONMENT; VOL III - SOCIAL AND ECONOMIC ELEMENTS.
For primary bibliographic entry see Field 5A.
W79-06449

GEOLOGICAL FEATURES,
California State Univ., Long Beach.
J. Dennis.
In: A Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas, Vol. 1, p 1-1 - 1-59, September 1974. 11 fig, 2 tab, 222 ref.

Descriptors: *Baseline studies, *Hazards, *Geologic history, Resources development, Water pollution sources, Seismology, Earthquakes, Oil, *Outer Continental Shelf, Natural seeps, Tars.

Basic current knowledge of the geology in the Southern California coastal Zone and the offshore continental borderland is summarized and a guide to the relevant literature is provided. Southern California geology is complicated because large displacements along faults have subdivided the crust here into a number of morphotectonic segments or blocks whose mutual geologic relationships are still, in large measure, controversial. In the area under consideration, earthquake risk is greatest along the coast, diminishing seaward. Oil and tar, as well as gas seeps, are associated with the Los Angeles basin and its extension offshore. They do not extend south of Huntington Beach. Seeps are usually transient phenomena. Their exact source on the sea floor is very difficult to determine. Commonly, they occur as groups of small individual seeps concentrated in a restricted area where a structural trap has been tapped by erosion. They may be activated or reactivated by tectonic or seismic movement. Unstable slopes and cliffs are very characteristic of the coastal zone under consideration. A brief summary of slope evolution in late Pleistocene and Recent time is given. Subsidence has occurred in the area under consideration where fluids have been withdrawn from underlying rocks. This includes both groundwater and oil. Such subsidence can be prevented by controlled water injection during oil withdrawal. (See also W79-06449) (Sinha-OEIS)
W79-06450

CHEMICAL OCEANOGRAPHY,
California State Univ., Long Beach.
K. M. Chan.
In: A Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas, Vol 1, p 4-1 - 4-81, September 1974. 26 fig, 10 tab, 91 ref.

Descriptors: *Baseline studies, *Water pollution sources, *Chemistry, *Pollutant identification, *Water chemistry, *Water quality, Resources development, Environmental effects, Dispersion, Models, Waste, *Outer Continental Shelf, *Southern California Bight, Outfalls, Natural seeps.

The major water mass off Southern California is the California Current, which is an eastern boundary current of a large anticyclonic gyre in the Eastern North Pacific Ocean. The water carried southward by the California Current is low temperature, low salinity, but high dissolved oxygen content subarctic water. In the study area, the water is primarily from the Counter Current and the properties of the water will vary depending on the degree of mixing of the above current and water, and the extent of modification as a result of heating and cooling, dilution, evaporation, biological activity and, towards the coastal area, waste discharges. In the study area the main input of biologically oxidizable organic matter is from municipal waste dischargers. The trace metals input to the study area are classified as diffused and discrete sources. Their distribution pattern by area is summarized and their characteristics are discussed. The diffused sources in the study area include ocean dumping, aerial fallout, vessel waste and advective transport. The presence of the residues of polychlorinated biphenyls (PCB), and DDT compounds are widespread. Marine organisms caught from the waters off Southern California consistently contain higher concentrations of DDT residues than in those areas receiving extensive agricultural drainages. Oily substances in the marine environment may be derived from oil production, industrial wastes, municipal waste, spill during transportation, and accidents. The non-anthropogenic source of oil is probably from submarine seeps. (See also W79-06449) (Sinha-OEIS)
W79-06453

HYDROGRAPHY OF HARBORS, LAGOONS AND SLOUGHS,
California State Univ., Fullerton.
N. J. Maloney, and K. M. Chan.
In: A Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas, Vol 1, p 5-1 - 5-66, September 1974. 29 fig, 9 tab, 65 ref.

Descriptors: *Baseline studies, *Hydrography, *Water resources, Lagoons, Harbors, *Water pollution sources, Geomorphology, Coasts, Tides, Waste disposal, Water pollution, Resources development, Environmental effects, *Outer Continental Shelf, *Flushing, Southern California Bight, Sloughs.

The project area includes 18 lagoons and harbors that fall into the following general categories: (1) Salt marsh lagoons, (2) man-made small boat harbors, (3) man-made deep water harbors, (4) continental shelves protected by breakwaters, (5) estuaries of intermittent streams. Man has physically altered these bodies of water by construction for industrial, recreational, and residential purposes; and chemically altered the water by adding pollutants of various types. The larger embayments remain open to the ocean and receive tidal flushing. Seasonal storm run-off, power plant coolant water, and sewage outfalls increase the flushing rate. The health of a bay depends upon the relationship between the pollutant inflow and the flushing. The small lagoons are cut off from the ocean by barrier spits for long periods of time. They do not receive tidal flushing and may revert to fresh or hypersaline water depending on the local run-off conditions. These lagoons are highly vulnerable to pollution because they are not diluted by tidal action. (See also W79-06449) (Sinha-OEIS)
W79-06454

POLLUTION SOURCES,
California State Univ., Long Beach.
W. H. Reed, and T. P. Bakker.
In: A Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas, Vol 1, p 6-1 - 6-99, September 1974. 30 fig, 30 tab, 102 ref.

Descriptors: *California, *Water pollution sources, *Baseline studies, *Pollutants, Waste disposal, Heavy metals, Thermal pollution, Resources development, Environmental effects, Chlorinated hydrocarbon pesticides, *Outer Continental Shelf, Southern California Bight, Ocean dumping.

That portion of the Southern California Bight covered by this study and the tributary area bounded on the north, east and south by the Transverse and Peninsular ranges and the U.S. Mexican border are inter-related by several varied and/or extreme geographic-oceanographic-geomorphic, climatic and demographic conditions. The introduction of pollutants into the marine environment can occur as discharges from municipal waste water treatment plants, industrial plants, electrical generating stations, and water-borne vessels. Additionally, pollutants can enter the marine environment as surface runoff, aerial fallout, flaking and dissolution of antifouling vessel paints, and direct ocean dumping from barges and other vessels. Substances introduced include sewage sludge, waste water treated only to remove floatable and suspended solids, garbage, chlorine, phosphates and nitrates, heated water, chlorinated hydrocarbons and heavy metals. It should be noted that over one-half the population (nearly 11 million people) of the State of California reside in these portions of Los Angeles and San Diego Counties that contribute to the pollution of the area. This is over 5% of the U.S. population. (See also W79-06449) (Sinha-OEIS)
W79-06455

PHYTOPLANKTON,
California State Polytechnic Univ., Pomona.
R. Z. Riznyk.
In: A Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas, Vol. 2, p 7-1 - 7-33, September 1974. 8 fig, 2 tab, 106 ref.

Descriptors: *Baseline studies, *Phytoplankton, *Ecosystems, *Water pollution sources, Environmental effects, Toxins, Red tide, Waste disposal, Sewage disposal, Resources development, *Outer Continental Shelf, Southern California Bight.

The importance of phytoplankton in the ecology of Southern California coastal and offshore areas involves three major aspects: (1) Their productive nature is of paramount importance as the base of the food chain and any change in their abundance or community structure will invariably affect subsequent portions of the chain. (2) Excessive enrichment or eutrophication of local areas may result in the phytoplankton bloom which can discolor the water, produce noxious odors, cause fish kills, make shellfish unfit for human consumption and interfere with the recreational potential of an area. (3) Their uptake of toxic materials which may enter the food chain is of utmost importance to the seafood industry and the welfare of man. Most ecological research has been with regard to the effect of sewage outfalls on species composition, standing stock and productivity. Generally it has been noted that production and standing stock is highest in outfall areas than in control areas. No change in species composition has been noticed. No relationship has been established between the red tide and sewage outfalls. (See also W79-06449) (Sinha-OEIS)
W79-06456

ZOOPLANKTON,
California Univ., Irvine.
For primary bibliographic entry see Field 5C.
W79-06457

BENTHIC ALGAE AND GRASSES,
California State Univ., Fullerton.
S. N. Murray.
In: A Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas, Vol 2, p 9-1 - 9-61, September 1974. 2 fig, 10 tab, 146 ref.

Descriptors: *Benthos, *Algae, *Grasses, *Baseline studies, Ecology, Water pollution effects, Environmental effects, Resources development, *Outer Continental Shelf, Southern California Bight.

A summation and evaluation of published studies concerned with marine benthic algae and grasses of southern California is provided. Literature included in this report has been largely confined to that collected directly within the circumscribed area, although attempts have been made to include additional relevant material where appropriate. The great majority of the literature discussed has been concerned with macro-algae (Chlorophyta, Phaeophyta and Rhodophyta) and grasses (Spermatophyta) collectively referred to as macrophytes. Relatively little information exists on micro-algal components of the marine benthos, e.g., Cyanophyta (blue-green algae), benthic Bacillariophyta (diatoms) and benthic Chrysophyta (chrysophytes), for the southern California region as well as worldwide. The contents of this report have been organized under the topics of taxonomy, ecology and economic resources. (See also W79-06449) (Sinha-OEIS)
W79-06458

RECOMMENDATIONS FOR BASELINE RESEARCH IN CENTRAL AND NORTHERN CALIFORNIA RELATIVE TO OFFSHORE RESOURCE DEVELOPMENT,
For primary bibliographic entry see Field 5C.
W79-06464

SEA-FLOOR INSTABILITY OF CONTINENTAL SHELF OFFSHORE CENTRAL AND NORTHERN CALIFORNIA,
BBN-Geomarine Services Co., Oxnard, CA.
For primary bibliographic entry see Field 2J.
W79-06465

RECOMMENDATIONS FOR BASELINE RESEARCH IN WASHINGTON AND OREGON RELATIVE TO OFFSHORE RESOURCE DEVELOPMENT.
For primary bibliographic entry see Field 5C.
W79-06468

POLLUTING INCIDENTS IN AND AROUND U.S. WATERS, CALENDAR YEAR 1977.
Coast Guard, Washington, DC.
For primary bibliographic entry see Field 5C.
W79-06476

5C. Effects Of Pollution

NITRATE ANALYZER MONITORS AILING WELL,
Garden City Park Water District, NY.
For primary bibliographic entry see Field 5A.
W79-06007

QUALITY ASSURANCE PROGRAM FOR TRACE HYDROCARBON ANALYSIS,
National Bureau of Standards, Washington, DC. Analytical Chemistry Div.
For primary bibliographic entry see Field 5A.
W79-06021

TRANSPORT MECHANISMS AND HYDROCARBON ADSORPTION PROPERTIES OF SUSPENDED MATTER IN LOWER COOK INLET,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
R. A. Feely, J. D. Cline, and G. J. Massoth.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol VIII, Contaminant Baselines, p 11-72, October 1978. 20 fig, 5 tab, 38 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Bottom sediments, *Suspended load, *Oil pollution, *Circulation, *Estuaries, Environmental effects, Baseline studies, Resources development, Water resources, Alaska, *Outer Continental Shelf, *Cook Inlet, Crude oil, Estuarine processes.

The seasonal distributions and elemental composition of suspended particulate matter in Lower Cook Inlet were studied and compared with current patterns and bottom sediment distributions. In general, the suspended matter distributions appear to follow the pattern of circulation in Lower Cook Inlet and Shelikof Strait. Comparisons of physical characteristics of suspended matter and sediments from the central basin indicates that net sedimentation of the fine grained suspended particles is minimal. However, sedimentation may be occurring in the numerous embayments along the coast. Chemical analysis of the particulate matter reveals that fine grained aluminosilicate minerals comprise about 80-95% of the suspended matter with biogenic material making up the rest. Analysis of seasonal variations of the C:N ratio of the particulate organic matter indicates that organic matter of marine origin is dominant in summer whereas terrestrially derived organic material predominates in winter when productivity is low. Laboratory experiments involving the interactions between Cook Inlet crude oil and suspended matter from Lower Cook Inlet show that the accommodation capacity of suspended matter for crude oil increases with the concentration of added oil. Important parameters in the accommodation process include: the chemical nature and viscosity of the oil; the mineralogical and size characteristics of the particulate matter; temperature; and degree of mixing. (Sinha-OEIS)
W79-06022

IDENTIFICATION OF NATURAL AND ANTHROPOGENIC PETROLEUM SOURCES IN THE ALASKAN SHELF AREAS UTILIZING LOW MOLECULAR WEIGHT HYDROCARBONS,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
For primary bibliographic entry see Field 5A.
W79-06023

NATURAL DISTRIBUTION AND ENVIRONMENTAL BACKGROUND OF TRACE HEAVY METALS IN ALASKAN SHELF AND ESTUARINE AREAS,
Alaska Univ., Fairbanks. Inst. of Marine Science.
For primary bibliographic entry see Field 5B.
W79-06024

HYDROCARBONS: NATURAL DISTRIBUTION AND DYNAMICS ON THE ALASKAN OUTER CONTINENTAL SHELF,
Alaska Univ., Fairbanks. Inst. of Marine Science.
D. G. Shaw, P. Else, R. Gritz, G. Malinky, and G. Mapes.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol VIII, Contaminant Baselines, p 495-588, October 1978. 6 fig, 11 tab, append. 03-5-022-56.

Descriptors: *Baseline studies, *Water pollution sources, *Oil pollution, *Sediments, Environmental effects, Resources development, Alaska, Distribution, *Outer Continental Shelf, *Hydrocarbons, *Aromatic hydrocarbons, Petrogenic hydrocarbons, Biogenic hydrocarbons.

Work completed in the study of the distribution and dynamics of hydrocarbons on the Alaskan outer continental shelf is reported. A striking finding is the observation that sediments from the Beaufort Sea and from Cook Inlet contain suites of

aromatic hydrocarbons. The data indicate that the sources of these hydrocarbons are multiple and complex. It appears that anthropogenic pyrolysis may be a contributing source. This is the first hint that the Alaskan marine environment may not be generally pristine. A preliminary statistical treatment of multiple determinations of hydrocarbons in sediment is reported. Although this treatment is not complete, important conclusions can be reached about the relationship of present analytical variability to natural environmental variability. A study of the interactions of hydrocarbons with suspended sediments of Southcentral Alaska is presented in detail. Quantitative information about this process, which has been the subject of considerable speculation, is presented. (Sinha-OEIS)
W79-06025

CHARACTERIZATION OF ORGANIC MATTER IN SEDIMENTS FROM LOWER COOK INLET,
California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
For primary bibliographic entry see Field 5B.
W79-06026

ON THE PEROXODISULPHATE OXIDATION OF TOTAL NITROGEN IN WATERS TO NITRATE,
Uppsala Univ. (Sweden). Dept. of Analytical Chemistry.
F. Nydahl.
Water Research, Vol 12, No 12, p 1123-1130, 1978. 8 tab, 10 ref.

Descriptors: *Nitrate, *Nitrogen, *Oxidation, *Measurement, *Analytical techniques, *Methodology, Nutrients, Degradation(Decomposition), Koroleff method, Alkalinity, Water temperatures, Nitrites, Dyes, Cadmium, Hydrogen ion concentration, Reagents, Chemistry, Digestion.

An improved experimental basis is presented for the oxidation-process method of determining total nitrogen in natural waters (the standard methodology in use by the Scandinavian countries). Following a discussion of the proper concentrations of peroxodisulfate and sodium hydroxide for digestion and the proper pH and buffer system for reduction, a new reagent is proposed whose concentrations of peroxodisulfate and sodium hydroxide are founded on stoichiometric relations at the autodecomposition of the peroxodisulfate; the proper pH of 8.0 for reduction is achieved by adding the calculated amount of Tris (hydroxymethyl) aminomethane hydrochloride. A method is given for preparing potassium peroxodisulfate of a very low nitrogen blank. Digestion is performed at 100 or 120C. Requisite digestion time, a function of the autodecomposition of the peroxodisulfate, was 90 min at 100C, or 15 min at 120C. Yields obtained by oxidation of various nitrogen compounds were similar at both temperatures, but were dependent on the form of the nitrogen linkage. Accuracy of the method is dependent on the nature of the nitrogen compounds and their concentrations; a negative error of 0-8% seems probable. (Lynch-Wisconsin)
W79-06030

FACTORS AFFECTING PHOSPHATE ABSORPTION EQUILIBRIA IN LAKE SEDIMENTS,
Dufresne-Henry Engineering Corp., North Springfield, VT.
W. C. Ku, F. A. DiGiano, and T. H. Feng.
Water Research, Vol 12, No 12, p 1069-1074, 1978. 5 fig, 2 tab, 18 ref.

Descriptors: *Phosphates, *Absorption, *Equilibrium, *Lakes, *Sediments, *Cycling nutrients, Massachusetts, Lake Warner(MA), Lake Wyola(MA), Nutrients, Phosphorus, Model studies, Langmuir model, Mathematical models, Water pollution sources, Interstitial water, Eutrophication, Mesotrophy, Hydrogen ion concentration, Water temperature, Aluminum, Iron, Calcium, Chemistry, Oxidation-reduction potential.

A comparative laboratory study of phosphate absorption in noncalcareous sediments from Lakes Wyola and Warner, Massachusetts (16 km apart and connected by the Mill River) showed both aluminum and iron to be important binding metals, but sediment phosphate absorption in highly eutrophic Lake Warner was more controlled by iron, and in mesotrophic Lake Wyola more by aluminum. The Langmuir absorption model was used to describe quantitatively effects of redox, pH, and temperature on sediment equilibria. The model mathematically describes experimental data, and is compatible with a possible mechanism of phosphate binding. The difference between the sediments was evident from the less-diminished sorptive potential shown by Lake Wyola sediment under anaerobic conditions, and reinforced by comparison of absorption before and after oxalate extraction. A difference in phosphate binding was also seen in differences in pH dependency of absorption by the two sediments. Absorption isotherms at 11 and 20C also indicated a significant decrease in the exothermicity of the reactions at lower pH, suggesting that more than one mechanism is operative in the pH range of 5.5-7.0. Overlying water in Lake Wyola generally had a phosphate concentration of < 20 microg/l throughout the year, and interstitial phosphorus was 100 microg/l. In Lake Warner phosphate reached 9-100 microg/l in summer, decreasing to 60-80 microg/l in winter; interstitial phosphorus ranged from 400-600 microg/l. (Lynch-Wisconsin)
W79-06032

EVOLUTION OF CONTAMINATED GROUNDWATER IN HOLT COUNTY, NEBRASKA,
Nebraska Univ., Lincoln. Conservation and Survey Div.
For primary bibliographic entry see Field 5B.
W79-06071

RADIATIVE PROPERTY MEASUREMENTS FOR SELECTED WATER SUSPENSIONS,
Purdue Univ., Lafayette, IN. Heat Transfer Lab.
For primary bibliographic entry see Field 5A.
W79-06075

STUDY OF SULFATE PULP MILL EFFLUENT TOXICITY (ESTUDIO DE LA TOXICIDAD DE LOS EFLUENTES DE UNA FABRICA DE PASTA AL SULFATO),
A. P. Ribot, and A. T. Lopez.
Investigacion y Tecnica del Papel, Vol. 15, No. 57, p 742-754, July, 1978. 40 ref.

Descriptors: *Reviews, *Pulp wastes, *Toxicity, *Water pollution effects, Wastes, Kraft mills, Industrial wastes, Water pollution sources, Pulp and paper industry, Effluents, Fish, Invertebrates, Oxygen, Fungicides, Detergents, Bactericides, Waste water treatment.

This literature review covers the effects of kraft pulp mill effluents on fish and invertebrates, role of oxygen in the toxicity of such effluents, elimination of toxic substances, measurement of effluent toxicity, and other mill agents causing environmental problems (fungicides, bactericides, detergents, etc.). (Speckhard-IPC)
W79-06128

GENERAL ASPECTS OF WATER POLLUTION BY THE PULP AND PAPER INDUSTRY (ASPECTOS GENERALES DE LA CONTAMINACION DEL AGUA POR LA INDUSTRIA DE PULPA Y PAPEL),
I. Acosta-Contreras.
Instituto Forestal Latino-Americano, Merida, Venezuela, Boletin No. 52, p 27-54, 1977. 28 ref, 9 tab. English Summary.

Descriptors: *Pulp and paper industry, *Water pollution, Wastes, Industrial wastes, Water pollution sources, Pulp and paper industry, Effluents, Air pollution, Solid wastes, Water quality, Water analysis, Waste water treatment, Waste treatment, Legislation, United States, Canada, Foreign countries, Japan, Sweden, France, Economic impact, Water pollution control, Water pollution effects.

A review is presented of the influence of pulp and paper production on the environment (water pollution, air pollution, pollution by solid wastes, indirect pollution); the relationship between water quality and industrial processes (wood preparation, mechanical pulping, neutral sulfite semichemical pulping, sulfite pulping, sulfate pulping, pulp screening, washing, cleaning, and bleaching, paper machine operations, and finishing and converting); analysis of water pollution by the pulp and paper industry; methods for reducing water pollution (primary, secondary, and tertiary treatment within the mill, treatment outside the mill); legislation relating to the reduction of water pollution in the U.S.A., Canada, Japan, Sweden, and France; and the economic impact of water pollution control on the pulp and paper industry. (Speckhard-IPC)
W79-06130

COMPARISON OF SOME TOXICITY INDICATORS IN A STUDY OF THE EFFECT OF PULP AND PAPER INDUSTRY EFFLUENTS ON PONTOGAMMARUS ROBUSTOIDES (GRIMM) (SRAVNENIE NEKOTORYKH POKAZATELEI TOKSICHNOSTI PRI IZVCHENII VLIYANIYA STOCHNYKH VOD TSELLYULOZNOBUMAZHNOI PROMYSHLENNOSTI NA BOKOPLAVOV PONTOGAMMARUS ROBUSTOIDES (GRIMM)),
Akademiya Nauk Litovskoi SSR, Vilnius. Inst. Zoologii i Parazitologii.
I. B. Gazdzyauskaite.
Eksperimental'naya Vodnaya Toksikologiya, Vol. 6, p 105-110, 1976. 3 ref, 1 tab. English summary.

Descriptors: *Pulp wastes, *Water pollution effects, *Crayfish, *Toxicity, Wastes, Industrial wastes, Water pollution sources, Pulp and paper industry, Effluents, Aquatic animals, Alcohols, Yeast, Bleaching wastes, Water pollution.

The crayfish Pontogammarus robustoides (Amphipoda) was used to test the toxicity of effluents from two pulp and paper mills, including a mixed effluent from sulfite liquor preparation, pulp chlorination, bleach plant, and residual liquor from ethanol and yeast production; an overall effluent from pulp manufacture; and a paper mill effluent. All effluents were toxic. The mixed effluent was the most toxic. Paper mill effluent was the least toxic. The effects of pollutants included growth inhibition, reduced feed consumption, reduced respiration rate, and cannibalism. The most sensitive indicator was the hatching rate which decreased sharply at relatively low effluent concentrations (0.58% mixed effluent and 2.9% paper mill effluent). (Stapinski-IPC)
W79-06132

COMPLEMENTARITY OF THERMOREGULATORY RHYTHMS IN MICROPTERUS SOLMOIDES AND M. DOLOMIEUI,
Pennsylvania State Univ., Wilkes-Barre. Dept. of Biology.
W. W. Reynolds, and M. E. Casterlin.
Hydrobiologia, Vol. 60, No. 1, p 89-91, 1978, 1 fig, 14 ref.

Descriptors: *Environmental effects, *Temperature, Bass, Fish behavior, Niches, Photoperiodism, Thermoregulation, Preferred temperature.

Largemouth and smallmouth black basses were tested in an electronic thermoregulatory shuttle box, which permits a fish to control water temperatures by its movements between chambers monitored by photo cells, to determine temperature preference. With a LD 12:12 photoperiod, it was found that smallmouth bass had a preferred temperature peak of 30.1C during the latter portion of the photophase while largemouth bass were reaching a minimum of 27.1C. Smallmouth bass reached a minimum of 26.6C during the latter part of scotophase while largemouth bass reached a peak of 29.5C during mid-scotophase. The two species are sympatric over much of their ranges. It was concluded that the thermotemporal comple-

mentarity of the rhythms shown in this study suggest a possible mechanism which, in conjunction with differing light intensity preferences, could aid in segregating their respective niches. (Chilton-ORNL)
W79-06163

MATHEMATICAL MODELING OF EUTROPHICATION PROCESSES IN LAKE ONTARIO,
Manhattan Coll., NY. Dept. of Environmental Engineering and Science.
R. V. Thomann.
In: American-Soviet Symposium on Use of Mathematical models to Optimize Water Quality Management. Kharkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 208-242 (Discussion p 243-245), September 1978. 18 fig, 2 tab, 23 ref. EPA-600/9-78-024.

Descriptors: *Eutrophication, *Lake Ontario, *Model studies, *Great Lakes, *Water quality, *Phytoplankton, *Kinetics, Effects, Large lakes, Environmental control, Nutrient removal programs, Biological response, Conservation of mass, Model verification, Death rate, Net production, Circulation, Chlorophyll, Hypolimnetic recycling, Biological recycling, Nutrients, *Simulation analysis, Estimating, Systems analysis, Equations.

This research structures a mathematical modling framework of the major features of eutrophication in large lakes. Lake Ontario, the subject of intensive field work as part of the International Field Year for the Great Lakes, is used as the problem setting. The overall objectives of the research include: (1) determination of important interactions in lake eutrophication; (2) analysis of lake water quality and biological response to natural and man-made inputs; and (3) formation of a basis for estimating the direction of change to be expected under remedial environmental control actions. The problems of impairment of the quality of lake systems are magnified for 'large lakes' such as the Great Lakes. Their size precludes any immediate improvement in quality after control actions are taken; it is much more difficult to obtain reliable data on water quality biological structure and hydrodynamic circulation due to sampling difficulty. The general circulation may not be adequately known in relation to climatological and hydrological factors. Measures of phytoplankton populations are temporarily and spatially dependent and reflect complex interactions with nutrients, such as nitrogen and phosphorus, and upper trophic level predation. This report reviews works accomplished to date on development of a mathematical model of phytoplankton in Lake Ontario that hopefully will form a reasonable basis for estimating the effects of nutrient removal programs. (See also W79-06166) (Bell Graf-Cornell)
W79-06175

MODELING THE DISPERSION OF POLLUTION AND THERMAL POLLUTATION IN WATER BODIES,
Akademiya Nauk SSSR, Novosibirsk. Inst. of Hydrodynamics.
O. F. Vasilyev.
In: American-Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Kharkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 246-260 (Discussion p 261-262), September 1978. 4 fig, 11 ref. EPA-600/9-78-024.

Descriptors: *Water bodies, *Model studies, *Dispersion, *Water pollution, *Thermal pollution, Hydraulic flow, Probability density, Pollutant concentration, Hydrothermal processes, Diffusion, Laplace's function, Equations, Systems analysis, Numerical analysis.

The problem of water pollution caused by discharge of agricultural, industrial, and municipal effluents containing various pollutants is very real. In some cases, pollution can be linked with the discharge of heated water. Evaluation of the degree of influence of a pollution source on the water environment requires an evaluation of the resultant hydrodynamic and physical process, as well as the chemical-biological processes of self-purification. Mathematical models of water quality have been developed to describe these processes. They are based on the application of hydrodynamic equations of turbulent liquid motion and include equations that describe the mass balance of miscellaneous pollutants as well as heat and oxygen. The major hydrodynamic question is the definition of diffusion coefficients when compiling these equations. A survey has been taken of eight reports which studied separate aspects of the common problem of water pollution. The reports may be conditionally subdivided into three groups; this survey report is accordingly divided into the following three sections: (1) flow in water bodies; (2) hydrothermal processes in water bodies; and (3) convective diffusion. Special attention is given to numerical modeling of these phenomena in shallow water bodies. (See also W79-06166) (Bell Graf-Cornell)
W79-06176

DESCRIPTIVE SIMULATION MODEL FOR FORECASTING THE CONDITION OF A WATER ECOSYSTEM,
Scientific Research Institute of Engineering and Applied Mathematics, Rostov-na-Donu (USSR).
For primary bibliographic entry see Field 5A.
W79-06183

HF SURFACE-CURRENT MAPPING RADAR 1977 ALASKAN OPERATIONS--LOWER COOK INLET,
National Oceanic and Atmospheric Administration, Boulder, CO. Wave Propagation Lab.
For primary bibliographic entry see Field 7B.
W79-06187

OBSERVATIONS OF SURFACE TIDAL COMPONENTS IN LOWER COOK INLET USING A TWO-SITE HF DOPPLER RADAR SYSTEM,
National Oceanic and Atmospheric Administration, Boulder, CO. Wave Propagation Lab.
A. S. Frisch, and B. L. Weber.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol IX, Trransport, p 21-39, October 1978. 9 fig, 5 ref. NOAA, Outer Continental Shelf Environmental Assessment Program. Boulder, Colorado.

Descriptors: Tidal effects, *Oil spills, Radar, *Baseline studies, *Ocean currents, Coasts, Estuaries, Environmental effects, Resources development, Alaska, *Outer Continental Shelf, *Tidal currents, Oil transport, Cook Inlet.

The use of two HF radars for tidal surface current studies appears especially useful for looking at the spatial variability in complex coastal and estuarine areas. With limited data we have been able to see spatial effects in the 12 and 24 hour phase and amplitude of the tides. Examples are given. (Sinha - OEIS)
W79-06188

CURRENT MEASUREMENTS IN POSSIBLE DISPERSAL REGIONS OF THE BEAUFORT SEA,
Washington Univ., Seattle. Dept. of Oceanography.
K. Aagaard.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol IX, Transport. p 40-60, October 1978. 9 fig, append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-67.

Descriptors: *Ocean currents, *Oil spills, *Ocean circulation, Path of pollutants, Baseline studies, Water pollution, Environmental effects, Resources development, Alaska, *Outer Continental Shelf, *Beaufort Sea, Current measurements, Oil transport.

The picture which emerges from the work done on the outer shelf to date is of a regime that is quite energetic over a broad band of sub-tidal frequencies. The mean flow calculated for a sufficiently long period (possibly up to several months) is unquestionably eastward. The flow appears to be steered by the local bathymetry. Although the energetic time scales of the flow are those of synoptic meteorological events, no clear relationship between atmospheric and oceanic events has been shown to date, even in a phenomenological fashion. The implication with respect to the subsurface transport of pollutants and other substances on the outer shelf is that (1) in the mean they will move significant distances eastward along the shelf, and (2) trajectory prognosis would be meaningless at the present level of understanding. (Sinha-OEIS)
W79-06189

GULF OF ALASKA SHELF CIRCULATION,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
J. Schumacher, R. Charnell, S. Hayes, H. Mofjeld, and R. Muench.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol IX, Transport, p 61-213, October 1978. 54 fig, 8 tab, 55 ref, 2 append. NOAA, Outer Continental Shelf Environmental Assessment Program. Boulder, Colorado. RP0000R7120847.

Descriptors: *Ocean currents, *Ocean circulation, *Baseline studies, *Hazards, Oil spills, Water pollution, Environmental effects, Resources development, Alaska, *Outer Continental Shelf, *Gulf of Alaska, *Oil transport, Petroleum development.

Field investigations, begun in Autumn 1974, have and continue to provide data which aids our understanding of hydrographic, current and pressure regimes in the Gulf of Alaska. Many important features have been identified, including: the relation between bottom pressure and velocity; cross-shelf coherence; gyral circulation west of Kayak Island; the pronounced effect of the Alaskan Current inflow through Shelikof Strait; the presence of shelf edge waters in the nearshore regions of troughs; and, a description of flow in Lower Cook Inlet. Further work, primarily intensive data analysis, will focus on understanding these and similar features, and estimating their importance in assessing hazards related to petroleum development. (Sinha - OEIS)
W79-06190

ALASKA NUMERICAL MODELING,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
J. Galt, J. Overland, R. Stewart, C. Pease, and M. Hitchman.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol IX, Transport, p 214-326, October 1978. 31 fig, 10 tab, 13 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. R7120845.

Descriptors: *Mathematical models, *Ocean currents, *Meteorology, *Circulation, Baseline studies, Wind(Meteorology), Environmental effects, Alaska, Oil spills, *Outer Continental Shelf, Oil transport, Northeast Gulf of Alaska(NEGOA).

Numerical modeling of oceanographic and meteorological regimes provides an aide to the understanding of currents and winds in the Gulf of Alaska. Many important components have been developed, including: a diagnostic model for the prediction of surface currents, a regional meteorological model for the prediction of surface winds, and methodologies for simulating the temporal and spatial variations in the velocity fields. Later this

year field data will be interpreted and these parts integrated to give estimates of pollutant trajectories for the region with particular emphasis on NEGOA. The report presents a careful evaluation of the diagnostic model with a formalized approach to the boundary conditions and a restructuring of the model equations. Data sets are identified for applying the diagnostic model to NEGOA. The results of a one dimensional calculation with the regional meteorological model for NEGOA and a system for extrapolating the results to develop typical coastal wind fields are discussed. Results of two methods for arriving at a set of pressure maps which provide a good coverage of the climatology for the Gulf of Alaska are presented. Trajectory model development and schemes for incorporating field data and results from other models into trajectory calculations through an environmental disk system are also discussed. Future work is outlined with the discussion of the current progress on each individual task. (Sinha-OEIS)
W79-06191

BRISTOL BAY OCEANOGRAPHIC PROCESSES (B-BOP),
Washington Univ., Seattle. Dept. of Oceanography.
L. K. Coachman, T. H. Kinder, J. D. Schumacher, and R. L. Charnell.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol IX, Transport, p 327-575, October 1978. numerous fig, tab, ref, 2 append. NOAA, Outer Continental Shelf Environmental Assessment Program. Boulder, Colorado. R7120840.

Descriptors: *Hydrography, *Ocean currents, *Tides, *Hazards, Baseline studies, Oil spills, Water pollution effects, Environmental effects, Resources development, Alaska, *Outer Continental Shelf, *Bristol Bay, Oil transport, Petroleum development.

Field investigations, begun in Autumn 1975, are now beginning to bear fruit and our understanding of the hydrographic and current regimes in Bristol Bay is growing. Many interesting and important features have been identified, including fine structure, fronts, anomalously diminished tidal currents, and an eddy. Further work, primarily requiring intensive data analysis, will focus on understanding these and similar features, and estimating their importance in assessing hazards of petroleum development. (Sinha-OEIS)
W79-06192

STD MEASUREMENTS IN POSSIBLE DISPERSAL REGIONS OF THE BEAUFORT SEA,
Washington Univ., Seattle. Dept. of Oceanography.
K. Aagaard.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol IX, Transport, p 575-590, October 1978. 8 fig. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-67.

Descriptors: *Water pollution, *Path of pollutants, *Dispersion, Salinity, Temperature, Density, Freezing, Baseline studies, Environmental effects, Arctic Ocean, Resources development, Alaska, *Outer Continental Shelf, *Pollutant transport, Beaufort Sea.

Results of the study include: (1) the direct influence of freezing extends far below the local pycnocline, due to the differential movement of waters from a variety of locations seeking their density level; (2) there are considerable year-to-year differences in hydrography and anomalies can persist through several seasons; (3) it seems likely that in the mean there is a net flow of saline water onto the shelf in the lower part of the water column; and (4) the temperature signal of the Bering Sea water is largely erased within a month or two after freeze-up. The major implication of the STD work with respect to the transport and dispersal of pollutants is that at least the outer part of the shelf, e.g., that portion deeper than about 50 m, is an active area even after freeze-up. There is ample evidence both of large-scale motion along the shelf, and of cross-shelf flux and exchange with the Arctic Ocean to the north. (Sinha-OEIS)
W79-06193

LAGRANGIAN SURFACE CURRENT MEASUREMENTS ON THE OUTER CONTINENTAL SHELF,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
D. V. Hansen.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol IX, Transport, p 590-603, October 1978. 7 fig. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Currents(Water), *Circulation, *Path of pollutants, *Oil spills, Baseline studies, Resources development, Environmental effects, *Outer Continental Shelf, *Surface currents, *Oil transport, Trajectories, Gulf of Alaska, Bering Sea, Lagrangian current data.

The objectives of this work unit are to obtain Lagrangian current data for assessment of probable trajectories of oil spills in the Gulf of Alaska and the S.E. Bering Sea using drogued free drifting buoys located several times daily by a satellite positioning system. During the 1977 field season six buoys were deployed S.E. of the Pribilof Islands in the S.E. Bering Sea. These deployments were as successful as those of 1976. The longest surviving buoy has recently terminated transmission after nearly 7 1/2 months of successful operation since May 1977. An average buoy lifetime in excess of 135 days was achieved during this year. It is believed that most of the buoys failed after being caught in the ice at the end of the field year. One buoy grounded on St. George Island less than two months after deployment, and another grounded on St. Paul Island about six months after deployment. Overall, more than 820 days of surface current data were obtained in the region 54 - 59 degrees N, 163 - 178 degrees W. A principal early conclusion that can be drawn is that surface currents in the S.E. Bering Sea are characterized by extensive eddying with several day average current speeds on the order of 20 cm/sec or less. Sustained current speeds of greater than 30 cm/sec are rarely seen, at least during Summer and Fall. The net displacement of water from the region is even more sluggish. Typical long term displacements are on the order of 400 km in 100 days. (Sinha-OEIS)
W79-06194

STUDY OF CLIMATIC EFFECTS ON FAST ICE EXTENT AND ITS SEASONAL DECAY ALONG THE BEAUFORT-CHUKCHI COASTS,
Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
R. G. Barry.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol IX, Transport, p 604-708, October 1978. 5 fig, 3 tab, 14 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-91.

Descriptors: *Sea ice, *Seasonal, *Baseline studies, Oil pollution, Resources development, Environmental effects, Water pollution, Alaska, Path of pollutants, *Outer Continental Shelf, *Fast ice, *Climatic effects, Beaufort Sea, Chukchi Sea, Petroleum development, Oil transport.

Nearshore ice along Alaska's Beaufort Sea and Chukchi Sea costs undergoes an annual cycle of formation, extension, modification, ablation, and breakup. Many of the processes which contribute to this cycle are poorly understod, although it is generally recognized that meteorological and climatological factors are important influences for ice formation, motion, deformation, ablation, and breakup. This study is attempting to interpret ice characteristics and their time variations from remote sensing data supplemented by aircraft and field observations. This derived information covering both the Beaufort and Chukchi coasts is then compared with concurrent coastal weather conditions and regional atmospheric pressure patterns. Offshore petroleum development may involve temporary operations on the winter fast-ice surface or in the open waters during summer. Alternately, large, ice-resistant structures may be used year-round. An accurate assessment of the best operational modes and of the seasonal distribution of ice hazards requires that the normal patterns and variabilities of fast-ice characteristics and breakup processes be specified. Also, the pathways of pollutants deriving from oil spills or blowouts are dependent to some degree on the season, and, in summer, on relative progression of the breakup. It also seems significant that various faunal populations utilize the coastal environment, above and below the ice and in open water areas. Seasonal and interannual variations in the weather and ice characteristics are important factors affecting the distribution and movements of these populations. (Sinha-OEIS)
W79-06195

A METEOROLOGICAL BASIS FOR LONG-RANGE FORECASTING OF SUMMER AND EARLY AUTUMN SEA ICE CONDITIONS IN THE BEAUFORT SEA,
Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
J. C. Rogers.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol IX, Transport, p 709-719, October 1978. 2 fig, 6 tab, 8 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Forecasting, *Sea ice, *Meteorology, Baseline studies, Oil spills, Resources development, Environmental effects, Alaska, *Outer Continental Shelf, *Oil transport, Petroleum development, Beaufort Sea, Long-range forecasting.

The beginning of drilling operations and the movement of supplies and resources between Point Barrow and Prudhoe Bay, Alaska, has made an assessment of the Beaufort Sea ice regime imperative. The Beaufort Sea is ice covered approximately nine months of the year. Only between late July and early October (in favorable ice summers) is it possible to safely ship supplies along the coast. In more severe ice summers such as those of 1955 and 1975 shipping can be delayed or halted. The overall results of the study suggest that persistence of monthly air temperature anomalies at Barrow in conjunction with cautious application of periodicities in those temperatures can be successfully used as predictors of the severity or mildness of summertime Beaufort Sea ice conditions. Depending upon user needs these meteorologically based prediction techniques could feasibly used in other aspects of sea ice forecasting, particularly the time of freezeup. (Sinha-OEIS)
W79-06196

MECHANICS OF ORIGIN OF PRESSURE RIDGES, SHEAR RIDGES AND HUMMOCK FIELDS IN LANDFAST ICE,
Alaska Univ., Fairbanks. Geophysical Inst.
L. H. Shapiro, H. F. Bates, and W. D. Harrison.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol IX, Transport, p 720-760, October 1978. 8 fig, 12 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-55.

Descriptors: *Sea ice, *Offshore platforms, *Hazards, *Resources development, Baseline studies, Water pollution, Oil spills, Environmental effects, *Outer Continental Shelf, *Landfast ice, Petroleum development.

All three phases of this project are directly relevant to the design of offshore structures for OCS

development and to the safe conduct of related operations. Potential override by the ice sheet is a recognized hazard in all phases of exploration and development in the offshore area of the Beaufort Sea coast, and the state of the ice during the break-up period makes this a particularly hazardous time. Attempts have been made by industry to develop sensors which can be used to provide early warning of impending ice motion in the vicinity of a structure. The study of ice vibrations in progress under this project may prove to be a relatively simple and inexpensive method for accomplishing this. The results of two studies related to the association of the long period vibrations with high compressive stresses are presented. In addition, a series of measurements of the coefficients of both static and kinetic friction between ice and beach gravel were made, and these results have been used to calculate the stresses involved in driving the ice sheet up the beach at Barrow in July 1975. The results of these calculations are comparable to the forces required to form the ridges along the beach. The latter forces were calculated from a modified version of the kinematic model of pressure ridging and these results are also given. (Sinha-OEIS)
W79-06197

MORPHOLOGY OF BEAUFORT, CHUKCHI AND BERING SEAS NEAR SHORE ICE CONDITIONS BY MEANS OF SATELLITE AND AERIAL REMOTE SENSING,
Alaska Univ., Fairbanks. Geophysical Inst.
W. J. Stringer, S. A. Barrett, and L. Schreurs.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol X, Transport, p 1-220, October 1978. 102 fig, 16 ref, append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-55.

Descriptors: *Sea ice, *Hazards, *Offshore platforms, *Oil pollution, Baseline studies, Resources development, Environmental effects, Alaska, Coasts, Remote sensing, *Outer Continental Shelf, *Petroleum development, Shore ice, Chukchi Sea, Beaufort Sea, Bering Sea.

Based on the combined seasonal morphologies, a zonal analysis of potential hazards related to offshore petroleum development has been made for the Chukchi and Beaufort seas. The hazards addressed are: safety of field personnel performing offshore geologic reconnaissance, large-scale displacement or deformation of fast ice sheet, the probability of formation of large ice ridge systems which could bring large forces to bear on offshore structures, and the possible fate of an under-ice oil spill. The general conclusion is that near shore sea ice behavioral patterns are similar from year to year thereby yielding some predictability in terms of offshore sea ice hazards to oil and gas development. The implications are that geographical zones of different design and construction criteria can be established in the offshore areas taking into consideration the probability of damage to the structure by adverse ice conditions and the relative risk imposed to the adjacent ecosystems. (Sinha-OEIS)
W79-06198

DEVELOPMENT OF HARDWARE AND PROCEDURES FOR IN-SITU MEASUREMENT OF CREEP IN SEA ICE,
Alaska Univ., Fairbanks. Geophysical Inst.
L. H. Shapiro, and E. R. Hoskins.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol X, Transport, p 221-259, October, 1978. 16 fig, 13 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-55.

Descriptors: *Sea ice, *Hazards, *Offshore platforms, *On-site tests, *Resources development, Baseline studies, Pollution, Water pollution, Environmental effects, Alaska, *Outer Continental Shelf, Petroleum development.

Any permanent or semi-permanent structure located off the Arctic Coast of Alaska must content with the hazard that sea ice presents to its stability. The extent of this hazard depends on three basic parameters. First, the strength of the structure itself, with respect to its ability to withstand forces of a given magnitude. Second, the geometry of the interaction between the structure and the surrounding ice, including the state of bonding between the two and, finally, the strength of the ice, which determines the maximum force that the ice can sustain in the mode of failure which the structure is designed to induce. The first two of these parameters are determined largely by the third, the strength of the ice, and it is to this problem that the project is directed. A field program is currently in progress in which it is intended to test about 100 samples of ice with dimensions of 30 x 30 x 60 cm in uniaxial compression. Tests are being conducted at constant load to examine creep and creep-rupture behavior, and at constant loading rates to determine the strength. The methods used and results to date are described. (Sinha-OEIS)
W79-06199

OPERATION OF AN ALASKAN FACILITY FOR APPLICATIONS OF REMOTE-SENSING DATA TO OCS STUDIES,
Alaska Univ., Fairbanks. Geophysical Inst.
For primary bibliographic entry see Field 7B.
W79-06200

CIRCULATION AND WATER MASSES IN THE GULF OF ALASKA,
Alaska Univ., Fairbanks. Inst. of Marine Science.
D. T. Royer.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol X, Transport, p 292-323, October 1978. 4 fig, 1 tab, 2 append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-56.

Descriptors: *Circulation, *Water masses, *Baseline studies, *Path of pollutants, Resources development, Pollution, Environmental effects, *Outer Continental Shelf, *Oil transport, Petroleum development, Gulf of Alaska.

The most important result of this year's research is the separation of precipitation and wind stress effects on the coastal dynamic height, and hence the coastal circulation. There is evidence of eddies and other perturbations in the circulation that are both temporary and permanent. The wind stress effects the circulation, but the exact mechanism or magnitude is not known. Besides the discovery of the precipitation effect, the shelf circulation appears to consist of a coastal current and a shelf break current with weak flow between them. There is some evidence for baroclinic flow into Prince William Sound. There is also evidence that fresh water runoff affects the transport in the Alaska Stream and that maybe this is a boundary between the coastal waters and oceanic waters. We have found that the geostrophic currents, as determined from CTD/STD measurements, correspond to results of the drifters. (Sinha-OEIS)
W79-06201

NEAR-SHORE METEOROLOGY,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
R. M. Reynolds.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol X, Transport, p 324-568, October 1978. 4 fig, 2 tab, 5 append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. R7120848.

Descriptors: *Winds, *Currents, *Oil spills, *Path of pollutants, Resources development, Baseline studies, Environmental effects, Alaska, *Outer Continental Shelf, Cook Inlet, Wind effects, Near shore meteorology, Petroleum development.

This study concentrates on the Lower Cook Inlet region which is the most vulnerable to industrial development. Research into the oceanic circulations in this encloaed region, reveals a chaotic unpredictable pattern, to a large extent controlled by the wind stress history over the water. This ability of the wind to control the current field, especially the near surface currents, coupled with the direct frictional coupling of the wind to the surface oil, confirms the importance of a knowledge of the wind field. Knowledge of the predictability of the winds in various regions is important for any shipping, platform service operations or aircraft operations, not to mention oil spill trajectory prediction. Thus, any areas which do not yield to existing forecast procedures, must be delineated. Either new forecasting techniques need to be developed, or direct telemeterins measurements must be made to properly specify the winds in these regions. The results of research thus far are summarized in five appendices to this report. (Sinha-OEIS)
W79-06202

MODELING OF TIDES AND CIRCULATIONS OF THE BERING SEA,
Rand Corp., Santa Monica, CA.
J. J. Leendertse, and S. Liu.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol X, Transport, p 569-579, October 1978. 18 fig. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-6-022-35249.

Descriptors: *Models, *Tides, *Circulation, Meteorology, Baseline studies, Resources development, Path of pollutants, Environmental effects, Alaska, *Outer Continental Shelf, Bering Sea, Petroleum development.

In the graphical system, the facility for vertical plots is extended to all variables. Computed time histories at selected depths up to six series can now be plotted on a single frame. To reduce compiling and storage costs, the graphic system consists of a fixed and a variable part, thus improving the efficiency of the storage usage. Computational subroutines in the program are independent of the model's dimensions and need not be recompiled for each case. A graphical system for analyzing tidal constituents in the modeled area determined from the computed water level data by means of Fourier transformation for each frequency considered in the model are being developed. (Sinha-OEIS)
W79-06203

COASTAL METEOROLOGY OF THE ALASKAN ARCTIC COAST,
Washington Univ., Seattle. Div. of Marine Resources.
E. Leavitt.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol X, Transport, p 580-606, October 1978. 15 fig, 3 tab, 12 ref, append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-67.

Descriptors: *Winds, *Meteorology, *Oil spills, Baseline studies, Resources development, Water pollution, Environmental effects, Alaska, *Outer Continental Shelf, *Oil trajectories, Petroleum development.

Given the strong correlation between winds measured at wide separations along the coast, it would be possible to provide winds for predicting coastal current trajectories with only a few measurement points. This would be more accurate than calculating the surface wind from the geostrophic wind; especially given the possibility of mesoscale phenomena such as the sea breeze and the necessity for simultaneously measuring boundary layer stratification. However, this must be qualified if winds are required further than 20 or 30 km offshore or inland from the coast. The relative ease with which pressure sensor equipped data buoys can be

set out on the ice, or for that matter inland from the coast, suggest their use in the latter case. The wind measurements along the coast could then serve as input to the calculation of surface winds from the pressure field. Such a combination of wind and pressure measurement stations could be set up and maintained for a relatively small expenditure, providing an excellent data base for studies of current (or oil spill) trajectories. (Sinha-OEIS)
W79-06204

CHARACTERIZATION OF THE NEARSHORE HYDRODYNAMICS OF AN ARCTIC BARRIER ISLAND - LAGOON SYSTEM,
Alaska Univ., Fairbanks. Geophysical Inst.
J. B. Matthews.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol X, Transport, p 607-627, October 1978. 7 fig, 16 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colo. 03-5-022-56.

Descriptors: *Hydrodynamics, *Food chains, *Circulation, *Baseline studies, *Water pollution effects, Arctic Ocean, Water temperature, Salinity, Turbulence, Food chains, Resources development, Environmental effects, Alaska, Obstruction to flow, *Outer Continental Shelf, *Nearshore processes, Petroleum development.

Physical circulation and processes occurring in the nearshore regions of the Beaufort Sea have a primary influence on the biological processes. Currents and water temperature, salinity and turbulence have a direct effect on organisms at the base of the food chain. These in turn affect the higher organisms such as fish and birds which are vulnerable to oil related impacts along the Alaskan north slope coast. The system is primarily driven in the open water season by meteorological events, water from the rivers appears to stay nearshore and move in a generally westward direction. Causeways and other solid structures appear to modify the longshore flow. Flushing times during strong winds and storms could be of the order of a few days and surface drifters reached Point Barrow from Purdhoe Bay in less than a week. Implications for oil and gas developments are that, during the open water season, spilled oil could be distributed over the whole coastline in about one week if it coincided with the frequent storm conditions. Preliminary results suggest that islands, causeways and other obstructions to longshore flow need to be designed with consideration for allowing free passage of the brackish river waters near the mainland shores. (Sinha-OEIS)
W79-06205

SEDIMENT CHARACTERISTICS, STABILITY, AND ORIGIN OF THE BARRIER ISLAND-LAGOON COMPLEX, NORTH ARCTIC ALASKA,
Alaska Univ., Fairbanks. Inst. of Marine Science.
A. S. Naidu.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol X, Transport, p 628-686, October 1978. 6 fig, 9 tab, 21 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-56.

Descriptors: *Exploitation, *Ecosystems, *Barrier islands, *Lagoons, *Environmental effects, Resources development, Baseline studies, Sediments, Oil spills, Alaska, *Outer Continental Shelf, North Slope, Beaufort Sea, Petroleum development.

The sedimentological studies are part of a larger interdisciplinary research effort to study the physicochemical and biological processes operative in the barrier island-lagoon ecosystem. It also entails establishment of an ecosystem model which can be put to use in predicting possible impacts resulting from both petroleum exploration and exploitation activities in the barrier island-lagoon complex of the Beaufort Sea coast. As a consequence of the OCS petroleum and gas development activities, the nearshore and the open shelf ecosystem of the Beaufort Sea is bound to be subjected to some degree of anthropogenic perturbations. The industrial activities which most likely will be introduced in this area include the construction of artificial islands and causeways for the use of drilling operations and docking facilities, dredging for maintaining navigation, and the exploitation of gravel and sand deposits from several possible sources as construction and fill materials. Already significant changes in the size distributions, benthic and chemical attributes of bottom sediments, as well as on the nearshore bathymetry have been recognized in the vicinity of Prudhoe Bay, consequent to the building of the new ARCO causeway. If the response of the physical environment and biological resources of the area to such changes can be properly assessed, or even predicted, it is quite possible that effective measures can be developed to protect or enhance existing resources. (Sinha-OEIS)
W79-06206

THE ENVIRONMENTAL GEOLOGY AND GEOMORPHOLOGY OF THE BARRIER ISLAND - LAGOON SYSTEM ALONG THE BEAUFORT SEA COASTAL PLAIN FROM PRUDHOE BAY TO THE COLVILLE RIVER,
Alaska Univ., Fairbanks. Dept. of Geology.
P. J. Cannon, S. E. Rawlinson, M. G. Moore, and J. Reuben.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol X, Transport, p 687-731, October 1978. 6 fig, 5 tab, 5 map. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-56.

Descriptors: *Geomorphology, *Detritus, *Baseline studies, Environmental effects, Barrier Islands, Lagoons, Resources development, Alaska, *Outer Continental Shelf, Environmental geology, Beaufort Sea, Petroleum development.

The purpose is to provide quantitative and qualitative data for assessing the environmental impact of development within the Simpson Lagoon area. Before environmental impact assessment is possible, however, past and present natural processes and conditions of the barrier island-lagoon system must be determined. Specific modeling requirements from the geomorphology subgroup are the volume and mass of detrital material introduced into Simpson Lagoon by shoreline erosion and from fluvial injection. Natural geological conditions and processes are best indicated by the individual landforms and/or the landform assemblages of the area. Recognition of these landforms and knowledge of the geomorphic processes by which they formed, enables the prediction of future changes, both natural and man-induced. Results of this investigation to date are presented in this report. (Sinha-OEIS)
W79-06207

OCEANOGRAPHIC PROCESSES IN A BEAUFORT SEA BARRIER ISLAND-LAGOON SYSTEM: NUMERICAL MODELING AND CURRENT MEASUREMENTS,
Texas A and M Univ., College Station. Dept. of Oceanography.
J. C. H. Mungall, R. W. Hann, Jr., D. J. Horne, R. E. Whitaker, and C. E. Abel.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol X, Transport, p 732-830, October 1978. 20 fig, 1 tab, 6 ref, append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-7-022-35182.

Descriptors: *Currents, *Barrier islands, *Lagoons, *Models, *Winds, *Resources development, Environmental effects, Baseline studies, Water pollution, Drilling, Oil pollution, Alaska, *Outer Continental Shelf, Beaufort Sea, Transport model, Petroleum development.

Simpson Lagoon, the principal study area and considered a typical example of an arctic barrier island lagoon system, lies some 10 miles to the west of Prudhoe Bay. The region will be subject to development should exploratory drilling occur offshore in the wake of the initial success of the Prudhoe Bay oilfield. One of the most likely points of impact will be the barrier islands, since they constitute convenient locations for offshore drilling. The modeling part of the investigation concentrated around the development of a two-dimensional vertically-integrated transport model and a three-dimensional multi-level model--both having the same 1 km x 2 km grid spacing and the same bottom topography. Findings from the modeling are that exchange rates and currents vary primarily with the angle between the wind and the lagoon axis (regardless of whether the wind is westerly or easterly) and of course with wind speed. Any discussion of the implications of these preliminary findings on OCS oil and gas development would be premature at this time, since any such implications are primarily related to possible biological impacts. (Sinha-OEIS)
W79-06208

DEVELOPMENT AND OPERATION OF A REMOTE SENSING DATA ACQUISITION PLATFORM FOR OCS STUDIES,
Naval Arctic Research Lab., Barrow, AK.
For primary bibliographic entry see Field 7B.
W79-06209

OIL SPILL VULNERABILITY OF THE BEAUFORT SEA COAST,
South Carolina Univ., Columbia. Dept. of Geology.
D. Nummedal, I. A. Fischer, and J. S. Knoth.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol X, Transport, p 853-859, October 1978. 2 fig, 2 tab, 7 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Geomorphology, *Barrier islands, *Oil spills, *Sediment transport, *Path of pollutants, Baseline studies, Environmental effects, Resources development, Water pollution, Alaska, *Outer Continental Shelf, *Oil transport, Beaufort Sea.

Project objectives were to characterize the morphology of the barrier islands and the mainland shoreline and to assess the retention potential for spilled hydrocarbons within the coastal environment. Measurements of littoral process variables along the mainland and island shores of the Beaufort Coast of Alaska are much too sparse to permit an evaluation of the spatial and temporal variations of beach sediment transport. Data presented in this report, however, are suggestive of a typical annual net transport rate of about 100,000 cubic meters to the west along the seaward beaches of the Beaufort barriers. The rate of longshore movement of coarse-grained beach material (sand and gravel) is found to range from essentially zero up to 4100 cubic meters per day. (Sinha-OEIS)
W79-06210

NORTON SOUND/CHUKCHI SEA OCEANOGRAPHIC PROCESSES (N-COP),
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
J. D. Schumacher, R. D. Muench, T. H. Kinder, L. K. Coachman, and R. L. Charnell.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol X, Transport, p 860-928, October 1978. 25 fig, 1 tab, 2 append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. R7120840.

Descriptors: *Hydrography, *Tides, *Currents, *Water pollution, Baseline studies, Resources development, Environmental effects, Oil pollution, Alaska, *Outer Continental Shelf, *Oil transport, Petroleum development.

The general objective was to relate oceanic advective and diffusive processes to potential pollution problems due to OCS petroleum development. Net flow through Bering Strait was northward throughout the winter of 1976-77 based upon records from moored current meters in Bering Strait and southeast of St. Lawrence Island. There was an overall factor of 2 decrease in kinetic energy density of northern Bering Sea currents at the time of ice formation, as recorded by the overwinter current meters. Tidal currents were extremely complex in the northern Bering Sea and Norton Sound regions. A mixed tide southeast of St. Lawrence Island gave way to a primarily diurnal tide in Norton Sound off Nome. In Bering Strait, there was no diurnal tidal signal and the semidiurnal signal was extremely small. Two summer hydrographic surveys of Norton Sound revealed a pronounced two-layered structure: a cold, saline near-bottom layer was overlain by a warmer, lower salinity upper layer. The lower layer, a remnant of the preceding winter's convective regime (surface cooling and ice formation) persisted throughout the summer. The overall distribution of temperature and salinity suggested a sluggish horizontal circulation in the eastern sound with a weak cyclonic circulation in the western portion; circulation was weaker in the lower than in the upper layer, and was negligible in the lower layer in the eastern sound. (Sinha-OEIS)
W79-06211

THE INTERACTION OF OIL WITH SEA ICE IN THE ARCTIC OCEAN,
Washington Univ., Seattle. Dept. of Oceanography.
S. Martin.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XI, Hazards, p 8-10, October 1978. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-67.

Descriptors: *Sea ice, *Hazards, *Oil spills, *Baseline studies, Laboratory tests, Resources development, Environmental effects, Alaska, *Outer Continental Shelf, Grease ice, Pancake ice, Oil transport.

The major laboratory effort is to develop a model for oil entrainment in grease and pancake ice; forms of ice which are important in the lee shore regions of Norton and Kotzebue Sound. Also, the laboratory pancake work is a rough model of how oil might spread in a field of larger floes. The work suggests that oil will collect in the grease ice at the point of transition from a liquid to a solid. In lease areas such as Norton and Kotzebue Sound, satellite photographs show that the grease ice forms in long narrow Langmuir-like plumes parallel to the wind. These plumes absorb the energy of the bi-directional wind-wave field. It is suspected from the experiments that oil spilled in these areas will be driven into the Langmuir plumes by the circulation, and collect in bands parallel to the grease ice. (Sinha-OEIS)
W79-06212

DYNAMICS OF NEAR-SHORE ICE,
Army Terrestrial Sciences Center, Hanover, NH.
A. Kovacs, and W. Weeks.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XI, Hazards, p 11-22, October 1978. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 01-5-022-1651.

Descriptors: *Sea ice, *Dynamics, *Hazards, *Engineering, Offshore platforms, Baseline studies, Resources development, Environmental effects, Water pollution, *Outer Continental Shelf, Fast ice, Nearshore ice, Petroleum development.

A knowledge of motion, deformation and physical characteristics of both the near-shore pack ice and the fast ice is essential to adequately designing and estimating the hazards associated with a variety of engineering options that may be considered for offshore operations in the near coastal areas of the Beaufort and Chukchi Seas. This program contributed directly to the solution of this general class of engineering problems in that it provides much of the geophysical and engineering data upon which sound engineering and regulatory decisions can be made. Detailed quantitative information on the movement and deformation of both the near-shore pack of ice and the fast ice along the coast of the Beaufort Sea has been obtained. Studies have also been carried out on the nature of the ridge systems located near the edge of the fast ice, on lateral variations in the thickness of first and multiyear ice, and on the internal structure of sea ice. The Narwhal Island area that is being studied is a portion of a coming lease sale, possesses favorable geologic structures and is a natural extension of the known Prudhoe Bay field. Basic information is provided by the remote sensing program on the distribution of ice types and features and in particular ridges that will be required as one aspect of a risk analysis for the construction of an offshore drilling platform sited on the edge of the Arctic Ocean. (Sinha-OEIS)
W79-06213

DYNAMICS OF NEAR SHORE ICE,
Washington Univ., Seattle. Polar Science Center.
R. S. Pritchard.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XI, Hazards, p 39-49, October 1978. 1 fig, 1 tab. NOAA, Outer Continental Shelf Environmental Assessment Program. Boulder, Colorado. 03-50-022-67.

Descriptors: *Sea ice, *Ice cover, *Path of pollutants, Oil spills, Resources development, Baseline studies, Environmental effects, Water pollution, Alaska, *Outer Continental Shelf, *Ice motion, *Oil transport, Chukchi Sea, Beaufort Sea, Petroleum development, Near shore ice.

Chukchi Sea ice motions are presented from March to September 1977, and the deployment of additional buoys in March 1978 is discussed. Observations of ice motions are relevant to problems of petroleum development for two broad reasons: (1) the ice cover will serve as a carrier of any petroleum products spilled in either the Beaufort or Chukchi Sea so that ice trajectories serve as the first estimate of the paths to be taken by the oil; and (2) the ice motion is an observable quantity that may be compared with simulated values to test the performance of an ice dynamics model which in turn may be used to determine a range of ice motions in a variety of environmental conditions. The ice motion data in the Chukchi Sea (both area wide and over the continental shelf) is particularly important because of its proximity to the Bering Sea which is a rich ecosystem that must be protected from pollution because of its high biological productivity. (Sinha - OEIS)
W79-06214

DELINEATION AND ENGINEERING CHARACTERISTICS OF PERMAFROST BENEATH THE BEAUFORT SEA,
Army Terrestrial Sciences Center, Hanover, NH.
For primary bibliographic entry see Field 2C.
W79-06215

OFFSHORE PERMAFROST STUDIES, BEAUFORT SEA,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 2C.
W79-06216

MARINE ENVIRONMENTAL PROBLEMS IN THE ICE COVERED BEAUFORT SEA SHELF AND COASTAL REGIONS,
Geological Survey, Menlo Park, CA. Pacific-Arctic Branch of Marine Geology.
P. Barnes, and E. Reimnitz.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XI, Hazards, p 148-299, October 1978. NOAA, Outer Continental Shelf Environmental Assessment Program. Boulder, Colorado. RK6-6074.

Descriptors: *Sea ice, *Hazards, *Permafrost, *Pipelines, *Drilling, Baseline studies, Resources development, Environmental effects, Oil pollution, Pollution, Alaska, *Outer Continental Shelf, Beaufort Sea, Petroleum development.

The marine geology and modern sedimentary environment off arctic Alaska is studied with emphasis on rates and processes and in particular the phenomena involving ice and its unique influence on the shelf and inshore environment. The character of the arctic continental shelf and coastal area, with its year round and seasonal sea ice and with it permafrost, faces the developer with many special problems. The interaction of the arctic shelf with the arctic pack ice takes the form of ice gouging and the formation of a large stamukhi zone each winter. Oil drilling and production during the next several years will probably not extend into the stamukhi zone seaward of the seasonal fast-ice zone. Of critical concern are the ice gouge and strudel scour effects on structures and pipelines. A similar emphasis has been taken by the Canadian Beaufort Sea Project in their more advanced state of knowledge and readiness to lease their outer continental shelf lands. The offshore drilling operation may encounter permafrost which could be substantially altered during the process of pumping hot oil up to the sea floor or along the sea floor in gathering and transportation pipelines. (Sinha-OEIS)
W79-06217

DISTRIBUTIONS OF GRAIN SIZE, TOTAL CARBON, HEAVY AND LIGHT MINERALS, CLAY MINERALOGY, AND INORGANIC GEOCHEMISTRY, OUTER CONTINENTAL SHELF, SOUTHERN BERING SEA,
Geological Survey, Menlo Park, CA.
J. V. Gardner, T. L. Vallier, W. E. Dean, K. A. Kvenvolden, and G. D. Redden.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XI, Hazards, p 300-383, October 1978. 32 fig, 7 tab, 30 ref, 2 append. NOAA, Outer Continental Shelf Environmental Assessment Program. Boulder, Colorado. RK6-6074.

Descriptors: *Sediment distribution, *Geochemistry, *Baseline studies, *Hazards, Minerals, Carbon, Environmental effects, Resources development, Alaska, *Outer Continental Shelf, Bering Sea, St. George Basin, Petroleum development.

The U.S. Geological Survey and BLM initiated a cooperative program to evaluate potential geologic hazards on the outer continental shelf area of the southern Bering Sea. The principle objectives of this study are to describe the distribution and types of surface sediment, and the processes effecting these distributions. The region covered in this study centers on the St. George Basin and covers an area bounded by the Aleutian Islands and Alaska Peninsula on the southeast, the shelf break at a depth of about 170 m on the southwest, the Pribilof Islands on the north and the 100 m isobath on the northeast. The present-day continental shelf of the southern Bering Sea is extremely flat and broad. Bottom gradients typically are much less than 0.25 degrees (1:13,000) and the large rivers that feed sediment into the Bering Sea, the Yukon, Kuskokwim, Kvichak, and to a lesser extent the Nushagak Rivers, are all over 500 km away from the St. George Basin area. Sediment is transported from these rivers into Bristol Bay but has almost no opportunity to be advected to the St. George Basin area because of the extremely low topographic gradient and insufficient watermass movement. Consequently it is believed that sediments are not presently being deposited on the outer continental shelf of the southern Bering Sea. This implies that all of the surface sediments are relict and that the sediments are Late Quaternary. (Sinha-OEIS)
W79-06218

YUKON DELTA COASTAL PROCESSES STUDY,
Houston Univ., TX. Dept. of Geology.
W. R. Dupre.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XI, Hazards, p 384-446, October 1978. 19 fig, 2 tab, 44 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Coasts, *Hazards, *Ice, *Geomorphology, Oil spills, Permafrost, Environmental effects, Baseline studies, Resources development, Sediment transport, Alaska, *Outer Continental Shelf, *Coastal processes, Yukon Delta, Petroleum development.

The Yukon delta is strongly influenced by the effects of ice in the ground, on the river, and offshore. Several of the major depositional environments of the Yukon delta appear to be restricted to ice-dominated coastlines. Similarly, the seasonality of coastal processes is dominated by the effects of ice throughout much of the year, thus a careful study of this region may provide insights into sedimentary processes and geologic hazards in other ice-dominated coastal zones as well. The siting of offshore facilities must take into account the mobility and deformation of seasonal pack ice, the extent and variability of shorefast ice, the probability of offshore permafrost, and the possible effects of altering offshore bathymetry in changing coastal stability. In addition, the evaluation of possible oil spills must take into account not only the dominant northward drift of water and suspended sediments, and the local and seasonal variability of current patterns, but also the role of sub-ice channels in affecting bedload transport. The selection of shoreline sites must take into account the present coastal stability, including the possibility of erosion associated with major storm surges. The effects of shorefast ice over half of the year must also be considered as well as the heterogeneity of the shoreline in determining oil spill vulnerability. (Sinha-OEIS)
W79-06219

EARTHQUAKE ACTIVITY AND GROUND SHAKING IN AND ALONG THE EASTERN GULF OF ALASKA,
Geological Survey, Menlo Park, CA. Office of Earthquake Studies.
C. Stephens, K. A. Fogleman, and J. C. Lahr.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XI, Hazards, p 447-474, October 1978. 9 fig, 20 ref, append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Hazards, *Earthquakes, *Baseline studies, Resources development, Environmental effects, Alaska, Oil spills, *Outer Continental Shelf, Gulf of Alaska, Petroleum development, Ground shaking.

The objective of this research is to evaluate the hazards associated with earthquake activity in the eastern Gulf of Alaska and adjacent onshore areas. These hazards may pose a threat to the safety of petroleum development. The current seismicity does not necessarily reflect the locations of large historical earthquakes. Large temporal variations in the rate of seismic activity have also been observed. Continued seismic monitoring will no doubt reveal other areas of activity and delineate other active geologic structures. Three earthquakes which occurred at the turn of the last century resulted in uplift of up to 14 meters between Cape Yakutaga and Yakutat Bay. Another onshore earthquake such as one of these or a great earthquake associated with low-angle oblique underthrusting of the sea floor beneath the continental shelf would be accompanied by strong ground shaking throughout much of the eastern Gulf of Alaska, possibly from Cross Sound to Kayak Island, and could trigger tsunamis, seiches, and submarine slumping, any of which could be hazardous to offshore and coastal structures. (Sinha-OEIS)
W79-06220

SEISMIC AND VOLCANIC RISK STUDIES – WESTERN GULF OF ALASKA,
Alaska Univ., Fairbanks. Geophysical Inst.
H. Pulpan, and J. Kienle.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. XI, Hazards, p 475-570, October 1978. 15 fig, 5 tab, 6 ref, 3 append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Earthquakes, *Volcanoes, *Hazards, Alaska, Baseline studies, Resources development, Environmental effects, Oil pollution, *Outer Continental Shelf, *Gulf of Alaska, Petroleum development.

This research was designed to determine the seismicity of the lower Cook Inlet, Kodiak Island, and the Alaska Peninsula and to evaluate the seismic risk to onshore and offshore development. Annual service, routine maintenance, and operation of the regional seismic network of 25 seismic stations constituted the largest portion of the field and laboratory activities. A fairly comprehensive assessment of the hazard associated with Augustine Volcano is provided, based upon both historical data and detailed studies in connection with the 1976 eruption. A similar, preliminary assessment is provided for the volcanic risk associated with Redoubt Volcano. (Sinha-OEIS)
W79-06221

SUBSEA PERMAFROST: PROBING, THERMAL REGIME AND DATA ANALYSIS,
Alaska Univ., Fairbanks. Geophysical Inst.
For primary bibliographic entry see Field 2C.
W79-06222

BEAUFORT SEACOAST PERMAFROST STUDIES,
Alaska Univ., Fairbanks. Geophysical Inst.
For primary bibliographic entry see Field 2C.
W79-06223

BENTHOS - SEDIMENTARY SUBSTRATE INTERACTIONS,
Alaska Univ., Fairbanks. Inst. of Marine Science.
C. M. Hoskin.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol. XII, Hazards, p 1-43, October 1978. 32 fig, 5 tab, 8 ref. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-56.

Descriptors: *Benthos, *Bottom sediments, Distribution, Water pollution, Baseline studies, Environmental effects, Resources development, Alaska, Particle size, *Outer Continental Shelf, Bering Sea, Petroleum development.

The main objective of the Bering Sea work was to determine relationships between the grain size mode of bottom sediment and distribution and abundance of the macrobenthos. Largest total number of individuals on a unit area basis occurred for stations having grain size modes of fine sand with smaller numbers of individuals at stations having coarser or finer sediment. Lowest total wet weight per square meter was found in these fine sand sediments, with larger weights of macrobenthos tending to occur at stations with coarser or finer sediment. It appears that the larger number of small individuals at fine sand stations is the result of current action. Particle size is only one of many parameters that control the distribution and abundance of benthic organisms. Careful consideration should be given to obtaining data for total organic carbon and the main components - protein, carbohydrate and lipid, to aid in characterizing the quality of organic carbon as food for the benthos. (Sinha-OEIS)
W79-06224

SHALLOW FAULTING, BOTTOM INSTABILITY, AND MOVEMENT OF SEDIMENTS IN LOWER COOK INLET AND WESTERN GULF OF ALASKA,
Geological Survey, Menlo Park, CA.
M. A. Hampton, and A. H. Bouma.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XII, Hazards, p 44-187, October 1978. 11 fig, 11 tab, 9 ref, 8 append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Sediment transport, *Path of pollutants, *Tectonics, *Faults(Geologic), *Hazards, Baseline studies, Resources development, Environment effects, Water pollution, Alaska, *Outer Continental Shelf, Gulf of Alaska, Petroleum development.

Environmental geologic investigations in Lower Cook Inlet and the western Gulf of Alaska were continued in 1977 with seismic profiling, side scan sonar, bottom sampling and underwater TV and camera the prime activities. Based on the 1976 reconnaissance study certain geologic phenomena were concentrated on that may pose a problem to development and need detailed studies before conclusions can be drawn. On the Kodiak shelf, the principal geo-environmental concerns are related to sediment distribution and movement, and to the structural-tectonic setting. Objectives, based on this premise, have been to determine sediment dispersal patterns across the shelf, to enable prediction of pollutant transport routes and storage sites, and to study the movement history of seafloor faults to determine which ones have recently been active and which have not. (Sinha-OEIS)
W79-06225

FAULTING, SEDIMENT INSTABILITY, EROSION, AND DEPOSITION HAZARDS OF THE NORTON BASIN SEA FLOOR,
Geological Survey, Menlo Park, CA.
H. Nelson, and D. E. Thor.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XII, Hazards, p 187-307, October 1978. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Hazards, *Faults(Geologic), *Sediment transport, *Gases, *Deposition, Storm surge, Currents(Water), Erosion, Path of pollutants, Water pollution, Resources development, Environmental effects, Ice, Alaska, *Outer Continental Shelf, *Bering Strait, Thermogenic gas, Biogenic gas, Petroleum development, Ice gouge.

Environmental evaluation of geologic phenomena in northern Bering Sea indicates faulting, ice gouging, bottom currents, storm surges, and gas-charged sediment pose potential problems to development of offshore resources. Potentially unstable near-surface sediment results from apparent thermogenic gas charging in a local area 40 km south of Nome and from a wide region of biogenic gas charging in north central Norton Sound. Geophysical, geotechnical, and geochemical evidence indicate that hydrocarbon gases of subsurface, thermogenic origin apparently migrate into the near-surface sediment along fault zones 30-40 km south of Nome. Gas migration from the subsurface accumulation to the surface sediment is indicated by smaller zones of reflector terminations observed in high-resolution profiles and more rapid penetration of the vibracorer in sediment at sites of surface acoustic anomalies. Any artificial structures penetrating the apparent large gas accumulation at 100 m or associated faults with gas-charged sediment may provide direct avenues for uncontrolled gas migration to the sea floor. Such structures also may encounter reduced bearing capacity in this gas-charged substrate. Present knowledge suggests that the offshore region surrounding the Yukon Delta and eastern Bering Strait areas have the combination of the most severe geologic hazards. Faulting and current scour are most intense near Bering Strait. Ice gouge, bottom-current scour and

storm surge activity are all intense over a wide area around the shallow prodelta area. Apparent gas cratering occurs throughout north central Norton Sound. (Sinha-OEIS)
W79-06226

SEDIMENT TRANSPORT IN NORTON SOUND - NORTHERN BERING SEA, ALASKA,
Geological Survey, Menlo Park, CA.
D. A. Cacchione, and D. E. Drake.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XII, Hazards, p 308-450, October 1978. 27 fig, 3 tab, 3 append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Hazards, *Path of pollutants, *Sediment transport, *Resources development, Oil spills, Baseline studies, Environmental effects, Alaska, *Outer Continental Shelf, *Oil transport, Bering Sea, Norton Sound, Petroleum development.

A multi-faceted investigation of sediment dynamics in Norton Sound and other sections of the Northern Bering Sea was conducted to define the principal pathways and mechanisms of bottom and suspended materials transport during the past two years. This research is extremely pertinent to two major impact areas of petroleum development in the marine environment: transport of materials including pollutants; and hazardous sea floor conditions produced by erosion caused by currents and waves. Oil that is absorbed by the fine suspended organic and inorganic material and that is mixed into the bottom sediments will be transported by the regional mean currents. The higher frequency currents such as tidal flow and surface wave-induced currents add local complications to the transport effects. The ability to predict accurately the movements of pollutants in the sea is strongly dependent on our knowledge of local transport processes. Specific geographic regions, like Norton Sound, will have unique aspects to the mechanisms which control the paths and amounts of material that is moved. It can now be demonstrated that storms play a major part in the transport of sediment in Norton Sound. Preliminary results show that ice transport of sediment may be highly significant in the Norton Sound area. (Sinha-OEIS)
W79-06227

COASTAL PROCESSES AND MORPHOLOGY OF THE BERING SEA COAST OF ALASKA,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 2J.
W79-06228

SHORELINE HISTORY OF CHUKCHI AND BEAUFORT SEAS AS AN AID TO PREDICTING OFFSHORE PERMAFROST CONDITIONS,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 2J.
W79-06229

SEISMOTECTONIC STUDIES OF NORTHEAST AND WESTERN ALASKA,
Alaska Univ., Fairbanks. Geophysical Inst.
N. N. Biswas, and L. Gedney.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XII, Hazards, p 575-619, October 1978. 10 fig, 5 tab. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-55.

Descriptors: *Hazards, *Earthquakes, *Structural engineering, Seismic studies, Exploration, Deformation, Oil pollution, Resources development, Baseline studies, Environmental effects, Alaska, Pipelines, *Outer Continental Shelf, Petroleum development, Beaufort Sea, Hydrocarbons, Icequakes.

The analysis of the seismic data gathered to date shows that, on the eastern part of Beaufort Sea shelf, the area north of Barter Island is subject to earthquakes in the magnitude range of from 5 to 6. During the exploration and development phases of the proven hydrocarbon reserves in this area, one of the design criteria for structures should be to withstand ground vibrations corresponding to those from a shallow earthquake (less than 20 km) of at least magnitude 6.0. Linear structures, like pipelines, used for transportation of oil or gas through the eastern part of the Brooks Range and the Chandalar and Yukon River basins should take into account the possibility of ground dislocations, perhaps by a significant amount over a period of time, at points of major mapped fault crossings. In the western part of Alaska, around the Seward Peninsula, analysis of the data gathered to date indicates a higher level of seismisity than was recognized prior to this study. This phenomenon appears to be common to both offshore and onshore areas. Further, consideration of the magnitudes of larger earthquakes indicates that this area is seismically more active than northeast Alaska. Some efforts were directed to investigate icequakes. The results show that fracturing of landfast ice sheets under meteorological instability can be effectively detected by seismic methods. (Sinha-OEIS)
W79-06230

ESTABLISH AND SERVICE A PRODUCT MARINE BASELINE DATA BASE FOR THE ALASKA MEA PROGRAM,
National Oceanic and Atmospheric Administration, Washington, DC. Environmental Data and Information Service.
J. J. Audet.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XIII, Data Management, p 42-63, October 1978. 4 tab, 4 append. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: Data collections, Data processing, Information exchange, Data storage and retrieval, Alaska, Baseline studies, Water pollution effects, Oil pollution, Resources development, *Outer Continental Shelf, Petroleum development.

Detailed information pertaining to data sets and data reports received and processed by the Data Centers is included in the March 1978 data tracking system and file type summary and other summary tables attached to this report. The majority of data received during the past year were biological data sets. A summary of data sets, data reports and ROSCOPs received during the year is included. (Sinha-OEIS)
W79-06231

A GEOGRAPHIC BASED INFORMATION MANAGEMENT SYSTEM FOR PERMAFROST IN THE BEAUFORT AND CHUKCHI SEAS,
Colorado Univ., Boulder. Institute of Arctic and Alpine Research.
M. Vigdorchik.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XIII, Data Management, p 77-306, October 1978. Chiefly maps. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 3-7-022-35127.

Descriptors: *Permafrost, *Maps, *Basic data collections, Baseline studies, Geography, Environmental effects, Water pollution effects, Resources development, *Outer Continental Shelf, *Information management, Beaufort Sea, Chukchi Sea.

This report includes two independent parts corresponding to the two principal objectives of the work. The first principal objective is to develop a computerized system to aid prediction of the distribution and characteristics of offshore permafrost. Development of this system involves (1) the gathering and study of all the source data about direct and indirect indicators of permafrost in the given area (depth, temperature and salinity of water, topography, bottom deposits, ice conditions, etc.) and (2) the compilation of the derived source maps and, subsequently, construction of candidate area maps for submarine permafrost in the Beaufort and Chukchi seas. The second objective is to undertake a comprehensive review and analysis of past and current Soviet literature on subsea permafrost and related natural processes. The available materials related to problems of submarine permafrost origin and development were given in the Quarterly Reports in 1977; this annual report gives a short summary of these materials. (Sinha-OEIS)
W79-06232

OCSEAP DATA PROCESSING SERVICES,
Rhode Island Univ., Kingston. Pastore Chemical Lab.
H. Petersen, Jr.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol XIII, Data Management, p 307-335, October 1978. 5 fig. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-7-022-35139.

Descriptors: *Data processing, *Quality control, Basic data collections, Baseline studies, Water pollution effects, Alaska, Environmental effects, Resources development, *Outer Continental Shelf, *Data management, Petroleum development.

Data sets received during the first few months of the year were used to establish the range and type of validation procedures which were necessary. Such procedures were in place by the second quarter, and have been continually refined based on experience gained from processing additional data. Improvements were made in the approach and in the types and appearance of the validation procucts CODEPULL and LOGLIST. A product developed during the second and third quarter presents a report summarizing the status of each data set being processed. A copy of this report, FOSREPT, is enclosed and shows the status of all data received during the past year. (Sinha-OEIS)
W79-06233

ACUTE TOXICITY OF COPPER TO SOME FISHES IN HIGH ALKALINITY WATER,
Illinois State Water Survey, Urbana.
D. Richey, and D. Roseboom.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 923, Price codes: A03 in paper copy, A01 in microfiche. Circular 131, 1978. 24 p, 6 fig, 5 tab, 43 ref, 2 append.

Descriptors: *Fish toxins, *Toxicity, *Illinois, *Laboratory tests, *Water pollution effects, Copper, Fish, Water pollution, Water quality, Channel catfish, Sunfishes, Data collections, Analytical techniques, Methodology, Bioassay, Alkalinity, Water properties, Mortality.

This study was concerned with documenting the acute toxicity effects that varying concentrations of copper have on certain fishes native to Illinois lakes and streams. The fishes observed were bluegill and channel catfish. Concentrations of copper were quantified in terms of its most toxic fraction to fish, i.e., soluble copper. The bioassays were of 14 days duration, and they were performed with various fish sizes and water temperatures. The results were derived from water high in the salts of calcium and magnesium with correspondingly high alkalinity. Acute toxicity curves were developed for each species permitting assessment for 14-day TL50 (toxicant concentration at which 50% of test specimens survive). The 14-day TL50 at 24C was 2.5 mg/l soluble copper for 0.5 gram bluegill, and 3.7 mg/l soluble copper for 1.5 gram bluegill. In the case of the channel catfish, apparently the more sensitive species to copper, the 14-day TL50 at 22C was 1.2 mg/l soluble copper. For the protection of the fishes investigated and in conjunction with the water pollution regulation of Illinois, the soluble copper levels in Illinois streams having water characteristics similar to those of the dilution water used should not exceed 0.12 mg/l. (Humphreys-ISWS)

W79-06235

ACCLIMATION TO TEMPERATURE AND DEATH AT HIGH CHANGING LETHAL TEMPERATURES IN CYPRINION MACROSTOMUS (HECKEL),
Mosul Univ. (Iraq). Dept. of Biology.
O. A. M. Al-Habbib, and W. M. S. Al-Habbib.
Journal of Thermal Biology, Vol. 4, p 75-77, 1979. 3 fig, 1 tab, 7 ref.

Descriptors: *Environmental effects, *Temperature, Resistance, Fish, Freshwater, Mortality, Lethal temperature, Acclimation.

Results of these laboratory investigations showed that lethal temperature increases with increasing acclimination temperature. LT50 increased from 34.0 to 39.3C, when acclimination temperature increased from 15 to 30C. Survival time at a changing lethal temperature is dependent upon the first lethal temperature to which the fish is exposed as well as the sequence of temperature changes. It is suggested that thermal resistance which occurred in the ascending order of lethal temperatures, may result from additional acclimination attained by the fish while in the resistance zone and that this may be of ecological importance. (Chilton-ORNL)
W79-06266

THE EFFECT OF TEMPERATURE ON THE CONVERSION OF PROINSULIN IN COD, GADUS MORHUA,
Memorial Univ. of Newfoundland, St. John's. Dept. of Biochemistry.
N. Liunardo, and C. L. Hew.
Journal of Thermal Biology, Vol. 4, p 79-83, 1979, 4 fig, 2 tab, 17 ref.

Descriptors: *Environmental effects, *Temperature, Biochemistry, Cod, Enzymes, Hormone activity.

The synthesis of proinsulin and its conversion to insulin were demonstrated at 15C in vitro. At 5C only proinsulin synthesis occurred. The conversion of proinsulin to insulin was found to be temperature-sensitive, reversible, and it was not inhibited by puromycin. It was concluded that the effect of temperature on the conversion of inactive prohormone to biologically active hormone might play an important role in controlling the level of active hormones under various environmental conditions. (Chilton-ORNL)
W79-06298

THE EFFECT OF LIQUID WASTE DISCHARGES FROM STEAM GENERATING FACILITIES,
Battelle Pacific Northwest Lab., Richland, WA.
H. E. McGuire, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as BNWL-2393, Price codes: A04 in paper copy, A01 in microfiche. Report BNWL-2393, 1977. 45 p, 7 fig, 6 tab, 42 ref, 1 append.

Descriptors: *Electric powerplants, *Water pollution effects, Water quality standards, Waste water, *Model studies, Suspended solids, Chlorine, Hydrogen ion concentration, Nutrients, Heavy metals, Oil, Radioisotopes, Model studies.

The effects of liquid waste discharges from steam electric generating facilities on the environment are summarized. Potential pollutants include chlorine, solids, impaired pH, nutrients, heavy metals (zinc, chrome, phosphorous), oil and grease, heat, and trace radionuclides. Existing water quality indices and development of a new model and scaling functions are discussed. The simple model is a comparative tool intended to be used as an evaluation method on multiple site alternatives. Effluent limitations developed by the Environmental Protection Agency make it almost certain that liquid waste water discharges from new facilities will cause little or no problem to the environment. (Small-FIRL)
W79-06357

ASSESSMENT OF TREATED VS. UNTREATED OIL SPILLS (INTERIM REPORT),
Rhode Island Univ., Kingston. Coll. of Engineering.
M. P. Wilson.
Available from the National Technical Information Service, Springfield, VA 22161 as HCP/W4047-02, Price codes: A18 in paper copy, A01 in microfiche. Report HCP/W4047-02, 1978. 410 p, 141 fig, 29 tab, 329 ref, append.

Descriptors: *Oil spills, Water pollution effects, Oil pollution, *On-site investigations, *Model studies, *Laboratory tests, *Toxicity, *Entrainment, Feasibility studies, Water pollution control.

A collection of nine papers is presented as part of a feasibility study designed to investigate the nature and extent of problems for assessing the advantages and disadvantages of treated vs. untreated oil spills and meso-scale type experiments and in-situ tests. Topics include: Drop size distributions and mixing energy; An oil spill fates model; Preliminary results of an experiment to measure rain induced oil entrainment; Procedures for qualitative and quantitative treated and untreated spills; Chemical analysis of water samples from meso-scale tanks; Collection and analysis of treated and untreated oil spill vapors; Microbiology: degradation potential; Lethal and sublethal effects of oil and dispersants on young bay scallops Argopecten irradians; A fishery-oil spill interaction model. (Small-FIRL)
W79-06366

A SUMMARY OF KNOWLEDGE OF THE SOUTHERN CALIFORNIA COASTAL ZONE AND OFFSHORE AREAS. VOL. I - PHYSICAL ENVIRONMENT; VOL II - BIOLOGICAL ENVIRONMENT; VOL III - SOCIAL AND ECONOMIC ELEMENTS.
For primary bibliographic entry see Field 5A.
W79-06449

PHYSICAL OCEANOGRAPHY,
California State Univ., Fullerton.
N. J. Maloney, and K-M. Chan.
In: A Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas, Vol. 1, p 3-1 - 3-65, September 1974. 30 fig, 12 tab, 78 ref.

Descriptors: *Baseline studies, *Waves(Water), *Tides, *Circulation, Resources development, Environmental effects, Water pollution effects, Path of pollutants, Upwelling, *Outer Continental Shelf, Southern California Bight, California Current, Physical oceanography.

Information concerning the oceanic circulation, waves, tides, and physical properties of the water in the Southern California Bight is summarized. Southern California is located on the eastern boundary of the North Pacific Ocean. As a result, the surface water seaward of the offshore islands moves south with the eastern boundary current, the California Current. A southerly current flows north below the California Current, and a southerly surface countercurrent occurs landward of the California Current. Seasonal coastal upwelling, mixed semidiurnal tides, and wave motion cause distinct circulation patterns in the littoral zone. No large tsunamis have been recorded in the Southern California area. This portion of the coast is less susceptible to large tsunamis than other coastal zones because of the wave refraction over the basin and ridge bathymetry of the borderland. The water in the Southern California Bight region of the California offshore is a mixture of relatively low temperature-low salinity water transported south in the California Current with higher temperature-higher salinity water brought north in the California Undercurrent. (See also W79-06449) (Sinha-OEIS)
W79-06452

PHYTOPLANKTON,
California State Polytechnic Univ., Pomona.
For primary bibliographic entry see Field 5B.
W79-06456

ZOOPLANKTON,
California Univ., Irvine.
R. R. Seapy.
In: A Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas, Vol. 2, p 8-1 - 8-99, September 1974. 3 fig, 16 tab, 54 ref.

Descriptors: *Baseline studies, *Oil pollution, *Water pollution effects, *Zooplankton, Resources development, Environmental effects, Biomass, *Outer Continental Shelf, Southern California Bight.

The species composition and distribution of the zooplankton in waters overlying the borderland are known from a series of studies that span a broad period of time and overlap only occasionally for any given year. Attempts to relate changes in abundance of zooplankton populations to the occurrence of oil spills have been unsuccessful because of the difficulty of relating any changes to oil pollution as the causative factor. The general decline of numbers and biomass was correlated with the general increase in pollution. However, it was not possible to relate these changes to specific pollutants. In addition to the demonstrated toxic effects on zooplankton, indirect effects should also be noted. Beneath a thick oil slick, the penetration of light may be reduced by 90%. Aside from the obvious effects of decreased light intensity on photosynthetic rate by phytoplankton populations, such a decreased light intensity could also disrupt normal patterns of depth distribution for zooplankters, interfere with diel migration patterns, and make visual predators less effective. (See also W79-06449) (Sinha-OEIS)
W79-06457

BENTHIC ALGAE AND GRASSES,
California State Univ., Fullerton.
For primary bibliographic entry see Field 5B.
W79-06458

BENTHIC INVERTEBRATES,
California State Univ., Fullerton.
D. B. Bright.
In: Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas, Vol 2, p 10-1 - 10-291, September 1974. 9 fig, 24 tab, 248 ref.

Descriptors: *Baseline studies, *Benthos, *Invertebrates, *Aquatic communities, Water pollution effects, Resources development, Heavy metals, Chlorinated hydrocarbon pesticides, *Outer Continental Shelf, Southern California Bight, Environmental impact.

The web of organisms found along the Southern California coast is extensive. Numerous benthic invertebrate species show a wide distribution while some are abundant but occur only in selected geographical areas. This report is divided into 3 major sections: major benthic invertebrate communities, environmental impact on benthic invertebrates, and species lists of major groups of benthic invertebrates. The Southern California coastal region contains some of the most rapidly expanding urban complexes in the United States. The waters within a few kilometers of shore are directly influenced by this intense development. If the ocean is to continue to satisfy the often conflicting demands of the human population, both aspects of the environmental quality issue must be considered. The degree to which marine ecosystems can be stretched thus becomes pivotal. Yet, whether it is possible to separate those events which are indigenous to the 'Natural' ecosystem from those due solely to man's influences is problematic. (See also W79-06449) (Sinha-OEIS)
W79-06459

FISHES,
California State Univ., Fullerton.
M. H. Horn.
In: A Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas, Vol 2, p 11-1 - 11-124, September 1974. 4 fig, 11 tab, 106 ref.

Descriptors: *Fish, *Baseline studies, *Oil pollution, *Environmental effects, Diseases, Heavy metals, Chlorinated hydrocarbon pesticides, Water pollution effects, Resources development, *Outer Continental Shelf, Southern California Bight, Petroleum hydrocarbons, Natural seeps.

The marine environment off southern California with its diverse chemical, physical, and geological characteristics provides a wide variety of habitats for fishes. Although numerous natural oil and gas seeps occur in the region and although oil drilling wastes are among the major wastes dumped in the study area, very little information is available on the effects of these materials on fishes of fisheries in southern California marine waters. In a survey of the effects of the Santa Barbara Channel oil spill, it was reported that fish were still present after the spill and that sampling in the area by the California Department of Fish and Game indicated no adverse effects. An analysis also did not reveal any abnormal conditions of fish and macroplankton populations. The reduction in the fish catch following the spill was said to be due to reduced fishing effort in the oily waters and to harbor closure at Ventura (because of flood damage) and at Santa Barbara (because of the oil spill). More research is needed on the effects of petroleum hydrocarbons on fishes especially in an area such as southern California where the biota is subject to both natural and man-caused contamination. (See also W79-06449) (Sinha-OEIS)
W79-06460

MARINE MAMMALS,
Southern California Ocean Studies Consortium, Long Beach.
M. D. Dailey.
In: A Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas, Vol 2, p 12-1 - 12-37, September 1974. 8 fig, 2 tab, 48 ref.

Descriptors: *Baseline studies, *Mammals, *Water pollution effects, Environmental effects, Resources development, *Outer Continental Shelf, Cetaceans, Pinnipeds, Carnivores, Southern California Bight, Environmental impact.

The reported marine mammal fauna of Southern California and the Channel Islands consist of cetaceans, pinnipeds and one carnivore. All three of these groups occur or have occurred in the study area, some as residents and others as transient recorded only by incidental sitings. Annotated species lists are presented giving range, study area sitings, population, life history and diseases. (See also W79-06449) (Sinha-OEIS)
W79-06461

MARINE AND SHORE BIRDS,
California State Univ., Long Beach.
K. E. Bender, C. T. Collins, and S. L. Warter.
In: A Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas, Vol 2, p 13-1 - 13-103, September 1974. 6 tab, 27 fig.

Descriptors: *Baseline studies, *Birds, *Habitats, *Oil spills, Water pollution effects, Environmental effects, Mortality, Resources development, *Outer Continental Shelf, Southern California Bight.

Habitats and the birds which occupy them in the study area of Southern California can be divided into aquatic communities and terrestrial communities. Environmental alterations in either salt or fresh-water habitats usually make considerable, and sometimes major, changes in the other as well. There are several ways in which elements of the bird fauna are highly susceptible to loss or severs (and irreversible) damage through human activity or development. Probably the most readily apparent of these danger points associated with increased human use of the area is the vulnerability of open-water and littoral zone birds to destruction by floating oil. Populations of some of these species have been much reduced in numbers already by various kinds of human interference, and a major oil spill in the area might so deplete the remaining populations that the species would not be able to recover and would be extirpated from the study area. Even in more numerous species where the danger of outright extinction or extirpation is less, the reduction in numbers will affect the population and the interrelated biological community for decades to come. It is essential that great care and attention be given to the prevention of these spills and leaks, rather than to the more dramatic and highly publicized, but largely unsuccessful, after-the-fact rescue and clean-up operations. (See also W79-06449) (Sinha-OEIS)
W79-06462

MARSHES AND BAYS,
California State Univ., Long Beach.
J-S. Ho.
In: A Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas, Vol 2, p 14-1 - 14-59, September 1974. 8 fig, 9 tab, 126 ref.

Descriptors: *Baseline studies, *Marshes, *Bays, *Ecosystems, *Biota, Crustaceans, Monitoring, Water pollution effects, Environmental effects, Resources development, *Outer Continental Shelf, Southern California Bight, Polychaeta, Environmental impact.

There are nineteen major coastal embayments in Southern California. Only three of them have remained relatively unaltered, i.e., Anaheim Bay, Upper Newport Bay, and Tijuana Estuary. Since very little biological survey of the marshes and bays was done in the past, a checklisted information of the flora and fauna of the area cannot be prepared. The biota of Anaheim Bay are comparatively better known and probably represent a possible flora and fauna of the Southern California coastal embayments before alteration. Several species of fish utilize the bay for spawning and nursery grounds and a great many species of birds use it as nesting, feeding, and shelter area. Polychaeta is the single most studied group of organisms, for certain species of them can be used as indicators of the bottom condition for monitoring pollution. A new form of extremely rare Crustacea was recovered from Anaheim Bay. It belongs to Cephalocarida, which is the most primitive living Crustacea of the world. The existing condition of biological knowledge underscores the difficulty in understanding the ecosystem of the coastal embayments and their relationship with the total coastal ecology, since a biological inventory is lacking and only a few species are known to a level of quantitative characterization, e.g., biomass, density per unit area, environmental cost. (See also W79-06449) (Sinha-OEIS)
W79-06463

RECOMMENDATIONS FOR BASELINE RESEARCH IN CENTRAL AND NORTHERN CALIFORNIA RELATIVE TO OFFSHORE RESOURCE DEVELOPMENT.
Proceedings of Conference/Workshop held in San Francisco, California, on October 22-24, 1976, Sponsored by the Bureau of Land Management, Niesen, T.M. (Ed.). San Francisco State University, San Francisco, CA School of Science. January 1977, 285 p, 4 append.

Descriptors: *Baseline studies, *Continental Shelf, *Resources development, Monitoring, Fisheries, Wildlife, Water pollution effects, Water pollution sources, *Outer Continental Shelf, Northern California, Central California.

During three days of meetings at the conference on baseline research in northern and central California relative to offshore resource development, the participants in the conference developed a number of recommendations for baseline research in this geographical area. The first section of this initial report represents an attempt to coordinate the recommendations, and to group them into four categories: general recommendations which speak to the overall framework in which the research is to be carried out, recommendations for baseline studies, recommendations for monitoring studies, and recommendations for special projects. The second section of the report attempts to establish an operational framework within the work which is designed to optimize the utilization of resources and to encourage an interdisciplinary understanding of the north and central California continental shelf region. (See W79-06465 thru W79-06467) (Sinha-OEIS)
W79-06464

SEA-FLOOR INSTABILITY OF CONTINENTAL SHELF OFFSHORE CENTRAL AND NORTHERN CALIFORNIA,
BBN-Geomarine Services Co., Oxnard, CA.
For primary bibliographic entry see Field 2J.
W79-06465

OCEANIC AND ATMOSPHERIC VELOCITY FIELDS AND WATER CHEMISTRY,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
For primary bibliographic entry see Field 2K.
W79-06466

FISHERIES AND WILDLIFE,
California State Dept. of Fish and Game, Menlo Park.
J. L. Baxter.
In: 'Recommendations for Baseline Research in Central and Northern California Relative to Offshore Resources Development', Proceedings of Conference/Workshop, held in San Francisco, CA, October 22-24, 1976, p 129-135, January 1977.

Descriptors: *Resources, Development, *Data collections, Baseline studies, Fisheries, Wildlife, Birds, Mammals, Water pollution effects, Oil pollution, Drilling, *Outer Continental Shelf, Petroleum development, Northern California, Central California.

The potential impacts of offshore oil and resource development on fisheries are of two principal types. One is the actual effects of petroleum products upon any or all developmental stages of the organisms themselves resulting from a spill or other accident. The other is the 'preemption' of fishing grounds by drilling operations, various underwater structures such as pipelines, wellheads, etc., and other activities related to activities in the offshore area. Marine birds are particularly sensitive to man's exploitation of resources in the marine environment. Some sea birds are more vulnerable to oil at sea than almost any other organism. There is not a great deal of information particularly of a systematic and continuing type on the distribution and abundance of marine birds. Studies of the effects of oil pollution on marine mammals are not extensive and no accurate prediction on its impact can be made at this time. Some studies have indicated that surface exposure to oil has relatively little effect on non fur-bearers, such as stellar and California sea lions, elephant seals, and harbor seals. The sea otter is one of the most susceptible to oil spills and most studied. It is quite obvious that although many of the data systems are in excellent shape, there is a great deal of information needed if we are to design programs which will provide the data necessary to evaluate offshore resource development. (See also W79-06464) (Sinha-OEIS)
W79-06467

RECOMMENDATIONS FOR BASELINE RESEARCH IN WASHINGTON AND OREGON RELATIVE TO OFFSHORE RESOURCE DEVELOPMENT.
Proceedings, Conference/Workshop, December 15-17, 1976, Portland, Oregon. Research Triangle Institute, Research Triangle Park, NC, February 1977. Massoglia, M.F. (Comp.). 313 p, 4 append. AA550-CT6-54.

Descriptors: *Baseline studies, *Washington, *Oregon, *Resources development, *Planning, *Management, Exploration, Drilling, Hazards, Water pollution sources, Water pollution effects, Fisheries, Birds, Biota, *Outer Continental Shelf, Petroleum development.

The conference/workshop was cosponsored by the Bureau of Land Management and conducted and cosponsored by the Research Triangle Institute. The objectives were: to summarize available information needed to understand the environmental processes of the Continental Shelf off Washington and Oregon; to provide any predictions presently possible of the effects of OCS oil and gas development on the environment of the Washington and Oregon OCS area; to identify subject areas in which additional information is required for reasonable prediction and understanding of the environmental effects of oil and gas development in this area; and to formulate recommendations for a studies program that will help determine the environmental impacts of drilling in the Washington and Oregon OCS area. The recommendations of the various workshops are summarized and structured into priority groupings. Study recommendations to develop environmental data required for decisionmaking during leasing activities are considered to be of the highest priority and are placed in Group I. Studies designed to develop data required for the exploratory-drilling and production-drilling phases are placed in Group II, and other construction activities and production operations are in Group III. Studies associated with abnormal conditions could fall into any of the three groups, depending on what phase of operation is concerned. (Sinha-OEIS)
W79-06468

RECOMMENDATION FOR BASELINE RESEARCH IN SOUTHERN CALIFORNIA RELATIVE TO OFFSHORE RESOURCE DEVELOPMENT.
Proceedings of Conference/Workshop held in Long Beach, California, on December 5-7, 1974, Sponsored by the U.S. Bureau of Land Management. February 1975. Lavenberg, R.J. and Earle, S.A. (Eds.). Southern California Academy of Sciences, Los Angeles. 266 p, 8 append.

Descriptors: *California, *Resources development, *Baseline studies, *Planning, *Continental Shelf, Environmental effects, Water resources, Water pollution effects, Aquatic biology, Oil pollution, Leases, *Outer Continental Shelf, *Southern California, Petroleum development, Environmental impact.

The conference and workshops were organized in such a manner that the proceedings resulting from them would summarize the environmental knowledge about the southern California Outer Continental Shelf and coastal areas. Specifically, the objectives for these meetings were: (1) to expose as much information as possible about each geographic area and discipline; (2) to provide a summary of available related information and understanding for a portion of the Continental Shelf as designated by the Bureau of Land Management in the southern California area; (3) to identify the areas of knowledge in which additional information is essential for reasonable prediction and understanding of the environmental effects of drilling in this area; (4) to formulate recommendations for baseline and monitoring programs adequate for determination of the environmental effects and impact of oil and gas development on the Outer Continental Shelf in this area; and (5) to provide wide public participation and exposure. (Sinha-OEIS)
W79-06469

U.S. GEOLOGICAL SURVEY OFFSHORE PROGRAM OF RESOURCE AND GEO-ENVIRONMENTAL STUDIES AND TOPICAL INVESTIGATIONS, PACIFIC - ARCTIC REGION,
Geological Survey, Menlo Park, CA.
D. W. Scholl.
Open-File Report No 78-422, 1978. 113 p, 22 fig, 2 tab, 4 append.

Descriptors: *Pacific Ocean, *Arctic Ocean, *Bibliographies, *Resources development, Geology, Oil, Gases, Environment, *Outer Continental Shelf, Petroleum development, Geo-environmental studies.

The Geological Survey's marine geology investigations in the Pacific-Arctic area are presented in this report in the context of the underlying socio-economic problem of expanding the domestic production of oil and gas and other mineral and hard- and soft-rock resources while maintaining acceptable standards in the marine environment. The primary mission of the Survey's Pacific-Arctic Branch of Marine Geology is to provide scientifically interpreted information about the (1) resource potential, (2) geo-environmental setting, and (3) overall geologic characteristics of the continental margins (that is, the continental shelf, slope and rise) and adjacent deeper water and shallower coastal areas off California, Oregon, Washington, Alaska and Hawaii and also, where it is of interest to the U.S. Government, more remote deep-sea areas of the Pacific-Arctic realm. (Sinha-OEIS)
W79-06470

SURFACE CURRENTS IN THE NEW YORK BIGHT AS RELATED TO A SIMPLE OIL TRAJECTORY MODEL,
National Oceanic and Atmospheric Administration, Washington, DC. Environmental Data and Information Service.
J. M. Bishop.
In: Preprint Volume: Conference on Coastal Meteorology, held Virginia Beach, VA on September 2123-1976. p 98-101, 1976. 4 fig, 8 ref. American Meteorological Society, Boston, Mass.

Descriptors: *New York, *Oil spills, *Models, *Water pollution effects, *Path of pollutants, Environmental effects, Baseline studies, *Outer Continental Shelf, *New York Bight, *Oil trajectory, Surface currents, Petroleum development.

A hypothetical path of oil movement is generated by computing trajectories from each third hourly wind observation. The results of two simulated spills are presented as probability diagrams. About 1000 simulated spills were used for each spill site. These diagrams indicate the percentage of time that a 10 mile x 10 mile offshore area and 10-mile coastal segments would be impacted by the calculated oil trajectories on an annual basis. Oil movements from both spill sites exhibit a strong offshore tendency. This might be explained in terms of the seasonal march of the annual wind and density field in the New York Bight. In the summer, winds are weak and combine with a strong southwesterly baroclinic flow to produce generally longshore oil movement. During the winter a strong eastward mean wind and a relatively weak baroclinic flow give a strong offshore tendency for oil movement. Thus, the annual pattern of oil movement exhibits a marked offshore and longshore (southerly) character. (Sinha-OEIS)
W79-06471

ATLANTIC OFFSHORE PROGRAM. A PRELIMINARY PLAN TO OBTAIN VITAL INFORMATION FOR THE NATION TO PROTECT AND USE ITS OFFSHORE RESOURCES,
Draft Report, prepared at the Atlantic Offshore Program Planning Workshop held at Newark, Delaware on September 19-21, 1977. Also as Delaware University Sea Grant Report No. DEL-SG-19-77m 1977. 464 p.

Descriptors: *Resources development, *Oceanography, *Baseline studies, *Conferences, *Engineering, Sediment transport, Dredging, Ocean waves, Soils, Pipelines, Management, Geology, Biology, Environmental effects, *Outer Continental Shelf, U.S. East Coast, Coastal processes, Geotechnical properties, Dredged material.

This workshop was a sequel to the May problem identification workshop and was held at the University of Delaware on September 18-21, 1977 and hosted by the 15 east coast Sea Grant institutions. The objective of this second workshop was the development of a preliminary plan for a comprehensive, economical, practical and sound oceanographic/oceanographic engineering program to solve, or shed useful light, on the priority problems identified in the users workshop of May 19-21, 1977. Task Groups reported on the following problems: dredged material disposal and sediment transport processes; assimilative capacity of the Atlantic offshore area; wave data acquisition and use; management of living resources; modeling physical processes; Atlantic offshore area and resources management; soil strength and stability; interaction of structures, equipment and marine environment. Specialty Teams prepared program plans for certain activities to strengthen and broaden the program. These activities are: physical oceanography; biological oceanography, chemical oceanography, geology and geophysical oceanography, instrumentation, communications, public interest and state participation, and management. (Sinha-OEIS)
W79-06472

AN ANALYSIS OF THE FEASIBILITY OF SEPARATING EXPLORATION FROM PRODUCTION OF OIL AND GAS ON THE OUTER CONTINENTAL SHELF.
Office of Technology Assessment, Washington, DC.
For primary bibliographic entry see Field 6A.
W79-06473

ANALYSIS OF BRINE DISPOSAL IN THE GULF OF MEXICO. BIOASSAY RESULTS.
National Oceanic and Atmospheric Administration, Washington, DC. Center for Experiment Design and Data Analysis.
Report to the Department of Energy Strategic Petroleum Reserve Program, Salt Dome Storage, March 1978. 118 p, 34 ref, 5 append.

Descriptors: *Gulf of Mexico, *Brine disposal, *Bioassay, *Baseline studies, *Salinity, Water pollution effects, Plankton, Benthos, Resources development, *Outer Continental Shelf, Petroleum development, Biological tolerance, Salinity tolerance, Environmental effects.

As crude oil is pumped into an existing cavern for storage, saturated brine is displaced and brought to the surface for disposal. Disposal of this brine into the Gulf of Mexico is one alternative and the Department of Energy has requested that NOAA assess the environmental consequences of such an operation. The offshore brine discharge is believed to primarily affect planktonic larvae and benthic species. The hypersaline tolerances of benthic and nektonic species expected to be present in the proposed disposal area, which may include penaeid shrimp, as well as important nektonic species, such as croaker, redfish, spot, black drum, sheepshead, and seatrout. There are no well-defined limits of biological tolerance to hypersaline conditions, and each species has a range of optimum salinity for growth and reproduction. Rate, duration, and magnitude of salinity changes are therefore important to assess the potential biological impact. Laboratory studies of salinity sensitivity of various organisms were conducted by NOAA contractors. The final reports on these studies are reproduced as appendices to this report. (Sinha-OEIS)
W79-06474

EFFECTS OF OCEAN DUMPING ACTIVITY MID-ATLANTIC BIGHT - 1976 INTERIM REPORT,
Environmental Protection Agency . Annapolis, MD.
D. W. Lear, M. L. O'Malley, and S. K. Smith.
Report No. EPA 903/9-77-029, July 1977. 184 p, 93 fig, 34 tab, 19 ref.

Descriptors: *Waste disposal, *Sewage sludge, *Water pollution effects, *Monitoring, Metals, Polychlorinated biphenyls, Mortality, Clams, Benthos, Mollusks, Sediments, Resources development, *Outer Continental Shelf, *Mid-Atlantic Bight, *Ocean dumping, Arctica islandica.

Significantly high concentrations of metals known to be present in City of Philadelphia sewage sludge can be found on occasion at points in the sediments in and near the sludge release site. Several bands with consistently high concentrations of metals, in association with high organic carbon, have been partially identified and have persisted for at least

fourteen months in and adjacent to the southern part of the sludge release site. Polychlorinated biphenyls (PCB's) were widely distributed in concentrations that may be inimical to marine organisms. The time distribution indicated cyclical inputs, possibly from the coastal zone. Localized areas of high impact, associated with other parameters from sewage sludge, have been identified. Mortalities of the mahogany clam, Arctica islandica, were indicated at loci in and near the ocean dumping activity. Detailed bathymetry of the persistently impacted area south of the sludge release site indicates gentle geomorphic features may affect the aggregation of dumped materials. Statistically significant changes of the benthic infaunal communities are occurring in the impacted area south of the sewage sludge release site. A preliminary indication of diseased macrofauna associated with the impacted area was found in February 1977. Molluscan shellfish in the vicinity of the sewage sludge site appear to harbor bacteria of sanitary significance. (Sinha-OEIS)
W79-06475

POLLUTING INCIDENTS IN AND AROUND U.S. WATERS, CALENDAR YEAR 1977.
Coast Guard, Washington, DC.
Commandant Instruction No. M16450.2 (old CG-487), July 1978. 33 p.

Descriptors: *United States, *Water pollution, *Data collections, *Oil spills, Water pollution sources, Baseline studies, Resources development, *Outer Continental Shelf, Petroleum development, Oil transport.

The Federal Water Pollution Control Act requires that any discharge of oil or hazardous substance in harmful quantities, be reported to the 'appropriate agency of the United States Government'. The Coast Guard has been designated as that agency by Executive Order 11735. The Pollution Incident Reporting System (PIRS) serves two purposes: first, it functions as a management information system for the Marine Environmental Protection Program; and second, it provides a means to respond to frequent inquiries from Congress, the press, special interest groups and the public concerning marine pollution and Coast Guard activities to protect the environment. Presently, the system contains data which describes the nature of the discharge, the response (cleanup) to the discharge and penalty actions. (Sinha-OEIS)
W79-06476

SUMMARIZATION AND INTERPRETATION OF HISTORICAL PHYSICAL OCEANOGRAPHIC AND METEOROLOGICAL INFORMATION FOR THE MID-ATLANTIC REGION,
National Oceanic and Atmospheric Administration, Washington, DC. Center for Experiment Design and Data Analysis.
R. G. Williams, and F. A. Godshall.
Final Report to the U.S. Bureau of Land Management, October 1977. 305 p. AA550-1A6-12.

Descriptors: *Oceanography, *Meteorology, *Path of pollutants, *Baseline studies, Water pollution, Oil spills, Environmental effects, Data, *Outer Continental Shelf, Mid-Atlantic region.

The results of an environmental study of the Mid-Atlantic region of the Outer Continental Shelf is presented. The area defined for this study is the area extending northward from 38 degrees N to 41 degrees N latitude between the coast and the 2,000 m isobath. The surface wind field, which plays an important role in determining the movement of spilled oil and other pollutants, is dealt with in detail. A major part of the report is devoted to the physical characteristics of the water masses in the Mid-Atlantic region, whose structure and variability are particularly relevant to the dispersion and advection of pollutants. Since diffusion, mixing, and advection are seldom measured directly, the potential for these processes must be inferred from analysis of such variables as water temperature, salinity, and density. In addition to an analysis of the surface and subsurface water temperature and salinity, data on dissolved oxygen and nutrient concentrations are presented, since these data are important for an evaluation of potential degradation rates of ocean pollutants. Circulation features analyzed include the mean surface current field and its variability, which act directly to advect and disperse pollutants; subsurface currents and their tidal constituents; and subtidal flows which produce large water mass characteristics. Some inferences concerning vertical mixing are drawn. Ocean waves are discussed which includes estimates of return periods of extreme wave heights in the region. Finally, the data used are evaluated in terms of reliability and deficiencies and recommendations are made for the design of future field programs to fill existing gaps in the data needed for an adequate environmental assessment. (Sinha-OEIS)
W79-06477

BEHAVIORAL THERMOREGULATION AND DIEL ACTIVITY IN WHITE SUCKER (CATOSTOMUS COMMERSONI),
Pennsylvania State Univ., Wilkes-Barre. Dept. of Biology.
W. W. Reynolds, and M. E. Casterlin.
Comparative Biochemistry and Physiology, Vol. 59A, p 261-262, 1978. 10 ref.

Descriptors: *Environmental effects, *Temperature, *Fish behavior, Laboratory tests, Suckers, *Thermoregulation, Preferred temperature.

White suckers were tested in an electronic thermoregulatory shuttle box, which permits a fish to control water temperatures by its movements between chambers monitored by photocells, to determine temperature preference. The range of preferred temperatures was the same during both day and night (22.8 to 26.1C) but the mode changed by 1C from 24C at night to 25C during the day. 89% of all activity occurred during the dark period. (Chilton-ORNL)
W79-06478

METABOLIC RATE, TEMPERATURE ACCLIMATION AND RESISTANCE TO HIGH TEMPERATURE OF SOFT-SHELL CLAMS, MYA ARENARIA, AS AFFECTED BY SHORE LEVEL,
Maine Univ. at Orono. Dept. of Zoology.
G. Anderson.
Comparative Biochemistry and Physiology, Vol 61A, p 433-438, 1978. 4 fig, 2 tab, 30 ref.

Descriptors: *Environmental effects, *Temperature, *Metabolism, Respiration, Clams, Intertidal areas, Resistance, Temperature acclimation.

Clams were collected from four levels (subtidal, low intertidal, mid intertidal and high intertidal) of a rocky beach. Oxygen consumption rates were measured at varying temperatures. It was found that, for intermediate size clams, metabolic rates were highest at the high intertidal level and lowest at the low intertidal level with subtidal and mid intertidal clams having intermediate rates. Clams from low intertidal levels showed near-complete metabolic compensation to temperature change. Clams from mid and high intertidal levels showed partial compensation. Clams from the subtidal level showed supraoptimal compensation. Warm acclimated clams from the subtidal level were found to be metabolically independent at temperatures ranging from 10 to 25C. Clams from subtidal and high intertidal levels were more resistant to high temperature (25C) than those from low and mid intertidal levels. (Chilton-ORNL)
W79-06479

BEHAVIORAL THERMOREGULATION IN THE ROCK BASS, AMBLOPLITES RUPESTRIS,
Pennsylvania State Univ., Wilkes-Barre. Dept. of Biology.
W. W. Reynolds, and M. E. Casterlin.
Comparative Biochemistry and Physiology, Vol 60A, No 4, p 263-264, 1978. 1 fig, 11 ref.

Descriptors: *Environmental effects, *Temperature, *Fish behavior, Bass, Photoperiodism, Thermoregulation, Preferred temperature.

Adult rock bass were tested in an electronic thermoregulatory shuttlebox, which permits a fish to control water temperatures by its movements between chambers monitored by photocells, to determine the occurrence of preferred temperature or locomoter activity. The fish attained final thermal preferendum at 30C within 24 hours and showed no difference in preferred temperature or in locomotor activity between day and night. (Chilton-ORNL)
W79-06480

ONTOGENETIC CHANGE IN PREFERRED TEMPERATURE AND DIEL ACTIVITY OF THE YELLOW BULLHEAD, ICTALURUS NATALIS,
Pennsylvania State Univ., Wilkes-Barre. Dept. of Biology.
W. W. Reynolds, and M. E. Casterlin.
Comparative Biochemistry and Physiology, Vol 59A, p 409-411, 1978. 1 tab, 25 ref.

Descriptors: *Environmental effects, *Temperature, Fish, Fish behavior, Biorhythms, Photoperiodism, Preferred temperature.

Adult and juvenile yellow bullheads were tested in an electronic shuttle box which permits a fish to control water temperatures by its movements between chambers monitored by photocells. The 24-hr mean preferred temperature of juveniles was 28.8C and of adults was 27.6C. Relatively little difference was seen in preferred temperatures among dusk, night and day periods. Juveniles were most active (40% of total 24 hr activity) during dusk period and adults were most active (63%) at night. In both cases, the respective 24-hr mean temperatures were equal to the mean preferred temperature during the period of greatest activity but there was no consistent relationship between highest and lowest preferred temperatures and the activity cycle. (Chilton-ORNL)
W79-06481

THE FINAL THERMAL PREFERENDUM OF FISHES: SHUTTLING BEHAVIOR AND ACCLIMATION OVERSHOOT,
Pennsylvania State Univ., Wilkes-Barre. Dept. of Biology.
W. W. Reynolds.
Hydrobiologia, Vol 57, No 2, p 123-124, 1978. 14 ref.

Descriptors: *Environmental effects, *Thermal pollution, Fish, Temperature, Fish behavior, Temperature preferendum.

Because fish tend to shuttle back and forth within a range of temperatures above and below the preferendum and because they acclimate more rapidly to increasing than to decreasing temperatures, it is suggested that they become acclimated nearer to the maximum than to the mean of a cycled thermal regime. Thus, thermoregulating fish can become acclimated to a temperature exceeding the final preferendum, even when given a free choice. These considerations imply that the ultimate temperature to which fish will gravitate in a gradient may not equal the crossover point at which preference and acclimation are equal. It is suggested that in future work it may be necessary to differentiate between crossover point and ultimate preferenda where these can be shown to differ significantly. (Chilton-ORNL)
W79-06482

GROWTH AND ADAPTATION TO SEA WATER IN UNDERYEARLING SOCKEYE (ONCORHYNCHUS NERKA) AND COHO (O. KISUTCH) SALMON SUBJECTED TO REGIMES OF CONSTANT OR CHANGING TEMPERATURE AND DAY LENGTH,
Fisheries and Marine Service, Nanaimo (British Columbia).
W. C. Clarke, J. E. Shelbourn, and J. R. Brett.

Canadian Journal of Zoology, Vol 56, No 11, p 2413-2421, 1978. 8 fig, 2 tab, 33 ref.

Descriptors: *Environmental effects, *Thermal pollution, Temperature, Growth rates, Salmonids, Sockeye salmon, Smolt, Photoperiodism, Animal physiology, Underyearlings, Coho salmon.

Regimes of constant as well as changing temperature and day length were found to influence growth and osmoregulatory performance of sockeye and coho salmon. Changing temperatures did not influence the final length or weight achieved by the fish in comparison with a constant temperature of the same mean but the growth patterns were different. Temperature controlled the rate of response to photoperiod and thus changes in growth rate due to photoperiod treatments were evident at higher temperatures before they were at lower temperatures. It was concluded that artificial photoperiod treatments are not required to produce underyearling sockeye smolts in the spring, provided that water temperatures are adequate for growth to 75 mm. Coho smoltify at a larger size than sockeye and would need higher temperatures to produce underyearling smolts in the spring. (Chilton-ORNL)
W79-06483

THE IMPORTANCE OF HABITAT TEMPERATURES FOR GROWTH IN THE TROPICAL CICHLID TILAPIA RENDALLI BOULENGER,
Rhodesia Univ., Salisbury. Hydrobiology Research Unit.
M. S. Caulton.
Journal of Fish Biology, Vol 13, No 1, p 99-112, July 1978. 4 fig, 6 tab, 32 ref.

Descriptors: *Environmental effects, *Thermal pollution, Temperature, Fish, Growth rates, Biorhythms, Fish behavior, Diel migration, Diurnal distribution, Tilapia rendalli.

Growth of Tilapia rendalli was investigated using a bioenergetic model to measure the effects of temperature on laboratory satiation, gross assimilation efficiency, calorigenic cost of food processing, ammonia excretion and energy budget. It was found that growth of the fish was enhanced by daily movement into areas of warm (as high as 34C) water during the day and return to cooler water (18C) at night. Optimal temperatures were predicted to be 18 and 30C. (Chilton-ORNL)
W79-06484

GROWTH, FOOD CONVERSION AND SURVIVAL OF O-GROUP ENGLISH SOLE (PAROPHRYS VETULUS GIRARD) AT FIVE TEMPERATURES AND FIVE RATIONS,
Oregon State Univ., Newport. Marine Service Center.
S. F. Williams, and R. S. Caldwell.
Aquaculture, Vol 15, No 2, p 129-139, October 1978. 6 fig, 1 tab, 23 ref.

Descriptors: *Environmental effects, *Temperature, *Food abundance, Growth rates, Fish, Mortality, Juveniles, English sole, Parophrys vetulus.

Young sole used in these investigations were fed a diet of Oregon Moist Pellets and were exposed to constant temperature-ration combinations between 9.5 and 21C and 0 and 16% rations for 12 weeks. Growth rate of the sole juveniles fed restricted rations was generally inversely related to temperature. Food conversion efficiency was highest (10.5% dry weight basis) at 8% ration and at 9.5C. Survival was low in all groups but highest at lower temperatures and higher rations. Several disease organisms caused or were associated with mortalities.
W79-06485

GROWTH AND SPAWNING IN THE PECTINID CHLAMYS OPERCULARIS IN RELATION TO TEMPERATURE AND PHYTOPLANKTON CONCENTRATION,
Portsmouth Polytechnic (England).
M. J. Broom, and J. Mason.
Marine Biology, Vol 47, No 3, p 277-285, 1978. 6 fig, 4 tab, 17 ref.

Descriptors: *Environmental effects, *Temperature, Food abunance, Mollusks, Growth rates, Spawning.

Growth rates and spawning conditions of queen scallops were monitored over a period of 18 months. Temperature and phytoplankton standing crop were also monitored. Shell growth was observed by the formation of lamellae and was found to occur most regularly under conditions of moderately high temperature and good food availability. Rapid growth in the spring resulted in the formation of a distinct ring. Development of the gonads and subsequent spawning did not appear to influence linear growth or lamella formation significantly. (Chilton-ORNL)
W79-06486

ACCUMULATION OF HEAVY METALS BY THE MARINE DIATOM DITYLUM BRIGHTWELLII (WEST) GRUNOW,
Melbourne Univ., Parkville (Australia). School of Botany.
G. S. Canterford, A. S. Buchanan, and S. C. Ducker.
Australian Journal of Marine and Freshwater Research, Vol 29, No 5, p 613-622, October 1978. 6 fig, 3 tab, 31 ref.

Descriptors: *Environmental effects, *Water pollution, Heavy metals, Absorption, Algae, Diatoms, Zinc, Lead, Copper, Cadmium, Biological concentration factor.

Accumulation of copper, zinc, cadmium, and lead by Ditylum brightwellii is reported. In the case of copper, no definite correlation was found between the amount of metal taken up by the diatoms and the metal concentration to which it was exposed. The amount of metals taken up generally increased with increasing concentration of the other metals studied. Metal uptake by the diatom was in the order of Zn > Pb > Cu > Cd. (Chilton-ORNL)
W79-06487

THE SURVIVAL OF EMBRYOS OF THE ANNUAL FISH NOTHOBRANCHIUS GUENTHERI EXPOSED TO TEMPERATURE EXTREMES AND THE SUBSEQUENT EFFECTS ON EMBRYONIC DIAPAUSE,
Orentreich Foundation for the Advancement of Science, Inc., New York.
J. R. Matias, and J. Markofsky.
Journal of Experimental Zoology, Vol 204, No 2, p 219-228, May 1978. 4 fig, 3 tab, 34 ref.

Descriptors: *Environmental effects, *Temperature, Growth stages, Fish, Embryonic growth stage, Diapause, Mortality, Nothobranchius guentheri.

Embryos of Nothobranchius guentheri were exposed to temperatures of -8.0, +3.4, 9.0, 32.7, 2nd 40.0C to determine thermal tolerance and responsiveness of embryos at diapause and at stages exclusive of diapause. Fully developed embryos and those at early stages of development were the most sensitive to temperature extremes. Specific early stages were not distinguished. Short exposure of Diapause I embryos to -8 and 3.4C eliminated Diapause II, while short exposure to 40C enhanced its duration. It was concluded that temperature is an important factor in influencing onset and duration of the diapauses. (Chilton-ORNL)
W79-06488

UPPER LETHAL WATER TEMPERATURE LEVELS FOR ENGLISH SOLE (PAROPHRYS VETULUS) AND ROCK SOLE (LEPIDOPSETTA BILINEATA) SUBJECTED TO GRADUAL THERMAL INCREASES,
National Marine Fisheries Service, Seattle, WA.
W. E. Ames, J. R. Hughes, and G. F. Slusser.
Northwest Science, Vol 52, No 3, p 285-291, 1978. 3 fig, 3 tab, 15 ref.

Descriptors: *Environmental effects, *Thermal stress, Thermal pollution, Temperature, Fish, Mortality, Seasonal, English sole, Rock sole.

Thermal tolerance studies are reported on 483 English sole and 260 rock sole. Test procedure was to gradually raise the temperature from ambient during the first hour, hold a test temperature (18, 21, 24, or 27C) for the next 4 hours, and gradually reduce temperature to ambient level during the 6th hour. Fish were observed during a 7 day period following tests. LL50 was found to be 26.1C for English sole and 24.9C for rock sole in the 27C test. LL50 was not reached at the other test temperatures. Death caused by thermal stress for both species was highest at each extreme of the respective size ranges. Total mortalities were 20% for English sole and 35% for rock sole. Mortality rates for both species appeared to be somewhat independent of seasonal water temperature fluctuations. (Chilton-ORNL)
W79-06489

DIEL PATTERNS OF PREFERRED TEMPERATURE AND LOCOMOTOR ACTIVITY IN THE GOLDFISH CRASSIUS AURATUS,
Pennsylvania State Univ., Wilkes-Barre. Dept. of Biology.
W. W. Reynolds, M. E. Casterlin, J. K. Matthey, S. T. Millington, and A. C. Ostrowski.
Comparative Biochemistry and Physiology, Vol 59A, p 225-227, 1978. 2 fig, 28 ref.

Descriptors: *Environmental effects, *Temperature, Fish behavior, Biorhythms, Preferred temperature.

Goldfish were tested in an electronic thermoregulatory shuttle box which permits a fish to control water temperatures by its movements between chambers monitored by photocells. Data showed a circadian rhythm with a unimodal peak (29.7C) of preferred temperature occurring during the 4 hrs preceding onset of the light period. Mean preferred temperature was 27.7C. Locomotor activity showed a bimodal pattern, with peaks occurring at the beginning and end of the dark period. There was no significant correlation ($r=0.05$) between temperature and activity. It was concluded that the most significant finding of the study was that the peak of the preferred temperature cycle of goldfish occurs during the same time period in which goldfish respond most favorably in body weight gain and in gonosomatic index to increased temperature. (Chilton-ORNL)
W79-06490

THE EFFECT OF THE RATE OF CHANGE OF TEMPERATURE ON THE RESISTANCE OF ASELLUS AQUATICUS (L.) TO HIGH LETHAL TEMPERATURES,
Trinity Coll., Dublin (Ireland). Dept. of Zoology.
T. M. Salih, and J. N. R. Grainger.
Journal of Thermal Biology, Vol 3, No 3, p 121-123, July 1978. 5 fig, 6 ref.

Descriptors: *Environmental effects, *Thermal pollution, Thermal stress, Temperature, Rates, Aquatic life, Adaptation, Acclimation, Temperature acclimation, Poikilotherms.

In this study on the effect of temperature rate change on survival at high temperatures it was found that the heat resistance of adult Asellus aquaticus increased with increasing acclimation temperature. Animals which had been acclimated to 20C and then heated to 35C at a rate of 1C/4 min were found to be less resistant at 35C than those placed directly at 35C. Similarly acclimated animals which were slowly heated to 30C and then suddenly placed at 35C exhibited increased heat acclimation in the more resistant individuals. It was concluded that when 20C acclimated Asellus are subjected to rising temperature, further acclimation takes place up to about 30C and this is most marked in the more resistant individuals. Above 30C the animals are adversely affected and this becomes progressively more intense as the temperature rises to 35C. (Chilton-ORNL)
W79-06491

EFFECT OF TEMPERATURE AND SALINITY ON HEAT TOLERANCE OF EMERITA HOLTHUISI,
Institute of Science, Bombay (India). Dept. of Zoology.
K. M. Kulkarni.
Geobios, Vol 5, No 3, p 97-100, 1978. 1 tab, 10 ref.

Descriptors: *Environmental effects, *Thermal stress, Temperature, Resistance, Salinity, Intertidal areas, Aquatic animals, Invertebrates, Crabs, Sand crabs.

Sand crabs were tested in four combinations of temperature and salinity (20 or 30C and 20% or 32% salinity). It was found that acclimation to high temperature generally increased resistance to lethal temperature and that low salinity generally decreased resistance. The most favorable combination for resistance to high temperature was acclimation to high temperature and high salinity. (Chilton-ORNL)
W79-06492

IMPLICATION OF GEOGRAPHIC LOCATION ON TEMPERATURE PREFERENCE OF WHITE PERCH, MORONE AMERICANA,
Maryland Univ., Frostburg. Center for Environmental and Estuarine Studies.
L. W. Hall, Jr., C. H. Hocutt, and J. R. Stauffer, Jr.
Journal of the Fisheries Research Board of Canada, Vol 35, No 11, p 1464-1468, 1978. 2 tab, 23 ref.

Descriptors: *Environmental effects, *Temperature, Fish, Perches, White perch, Location, Seasonal, Geographical regions, North Carolina, New Jersey, Maryland, Temperature preference.

Fish used in this study were collected from Albemarle Sound, N.C.; Wicomico River, MD; and Mullica River, N.J. Collection temperatures were 25C for each population. Fish were acclimated to 6, 12, 18, 24, 30, and 33C. Final temperature preference (calculated from linear regression) were 32.4C for North Carolina populations; 28.9C for Maryland populations; and 29.6C for New Jersey populations. Calculated final temperature preference (using the quadratic equation) for N.C., Md., and N.J. populations were 31.6, 29.3, and 29.2C, respectively. Final temperature preference from visual estimation were 32.5C for N.C. populations, 30.6C for Md. populations, and 28.6C for N.J. populations. It was concluded that geographical variations in temperature responses of white perch are a result of environmental differences found in each ecosystem. Yearly water temperature extremes of the three locations showed great variation. Nonthermal seasonal influences associated with each location could represent another possible means for influencing temperature preference. (Chilton-ORNL)
W79-06493

EFFECTS OF TEMPERATURE AND SALINITY ON THE METABOLISM AND BYSSAL FORMATION OF BRACHIDONTES VARIABILIS KRAUSS (BIVALVIA),
Hebrew Univ., Jerusalem (Israel). Dept. of Zoology.
S. Stern, and Y. Achituv.
Comparative Biochemistry and Physiology, Vol 59A, No 1, p 101-105, 1978. 6 fig, 3 tab, 25 ref.

Descriptors: *Environmental effects, *Temperature, *Salinity, Thermal stress, Adaptation, Metabolism, Intertidal areas, Mollusks.

Animals were acclimated to 21C and 42% salinity and then exposed to varying experimental regimes of temperature and salinity. It was found that an increase in temperature (from 27 to 33C) resulted in a net decrease in oxygen uptake. An increase in salinity (from 47 to 58%) resulted in a decrease in oxygen uptake. Combined increase in temperature and salinity resulted in initial fluctuations in oxygen uptake with a return to pretest rates. Nitrogen excretion increased in most of the experiments. At most of the temperature-salinity combinations, byssal activity recovered partially as compared to the acclimation conditions where byssal formation was 100%. At 33C, the first incidence of mortality was recorded 13 days after the start of the experiment. At 27C, the first mortality was found on the 26th day and 50% of animals were dead by the 96th day. It was concluded that the metabolic adaptation of this species is responsible for its ability to cross the Suez Canal and enter the Mediterranean. (Chilton-ORNL)
W79-06494

EFFECT OF TEMPERATURE, PH, ANTIBIOTICS, FORMALIN AND MALACHITE GREEN ON THE GROWTH AND SURVIVAL OF SAPROLEGNIA AND ACHLYA PARASITIC ON FISH,
Fisheries Research Inst., Szarvas (Hungary).
J. Olah, and J. Farkas.
Aquaculture, Vol 13, No 3, p 273-288, March 1978. 4 fig, 7 tab, 19 ref.

Descriptors: *Environmental effects, *Temperature, Hydrogen ion concentration, Parasites, Fish, Growth rates, Fungi, Fungicides, Fish parasites.

Twenty four strains of Saprolgenia and Achlya were isolated and tested for growth at different temperature and pH levels. Sensitivity and survival were determined for antibiotics and 40 combinations of formalin, malachite green and formalin-malachite green mixture. It was found that at low temperatures Saprolegnia strains grew faster than Achlya strains and that they germinate and begin growth in the spring at temperatures as low as 5C. Saprolegnia strains grew at a wider range of pH than Achlya strains. Nalidixic acid was the only antibiotic tested which exhibited an inhibiting effect on growth. Mixtures of malachite green and formalin were found to be the best fungicides. (Chilton-ORNL)
W79-06495

SYNERGISTIC EFFECTS OF TEMPERATURE, SALINITY AND LIGHT ON THE HERMATYPIC CORAL MONTIPORA VERRUCOSA,
Hawaii Inst. of Marine Biology, Honolulu.
S. L. Coles, and P. L. Jokiel.
Marine Biology, Vol 49, No 3, p 187-195, 1978. 2 fig, 6 tab, 30 ref.

Descriptors: *Environmental effects, *Temperature, *Salinity, *Light, Coral, Light intensity, Growth rates, Mortality, Interactions, Synergistic effects.

Colonies of Montipora verrucosa were acclimated to salinities of 20, 25, 30, 35 or 40% for 24 hours at normal ambient sea water temperatures of 23 to 27C and then exposed to rising temperatures at the rate of 0.5C/hour. In a second experiment, corals were exposed to varying intensities of light and temperature. It was found that temperature tolerance is affected by both light and salinity. At high temperatures, the ability of the coral to survive or resist damage is reduced by low salinities and high light intensities. In long-term growth investigations at both upper and lower sublethal temperatures, high light intensity resulted in substantial loss of zooxanthellar pigment, higher mortality rates, reduced carbon fixation and lowered growth rates. It was concluded that response of corals to a given ecological factor must vary with changes in other environmental parameters, and that these interactions are most important near the limits of tolerance for a given parameter. (Chilton-ORNL)
W79-06496

SIZE VARIATION AND THE DISTRIBUTION OF HEMIMETABOLOUS AQUATIC INSECTS: TWO THERMAL EQUILIBRIUM HYPOTHESES,
Academy of Natural Sciences of Philadelphia, Avondale, PA. Stroud Water Research Center.
B. W. Sweeney, and R. L. Vannote.
Science, Vol 200, No 4340, p 444-446, April 1978. 1 fig, 2 tab, 20 ref.

Descriptors: *Environmental effects, *Thermal pollution, Temperature, Aquatic insects, Growth rates, Larval growth stage, Mature growth stage, Size, Fecundity.

Two hypotheses are formulated concerning the importance of temperature to both size and geographical distribution of hemimetabolous aquatic insects. These hypotheses are based on laboratory data which suggest that modifying the optimum temperature regime by rearing insects in warmer or cooler environments affects the bioenergetic and developmental aspects of larval growth and results in lower individual adult weight and fecundity. It is suggested that these results may be critical to evaluating the affects of thermal pollution since warming the seasonal cycles of a river by 2 or 3C might eliminate species by affecting body size and fecundity. It was concluded that a geographically uniform set of data on larval growth rate, adult size, and fecundity for several species of aquatic insects is needed to test and refine the hypotheses. (Chilton-ORNL)
W79-06497

MICROSETELLA NORVEGICA (BOECK): A DIRECT RELATIONSHIP BETWEEN SEASONAL SEA TEMPERATURE AND ADULT SIZE IN A PLANKTONIC COPEPOD,
Newcastle-upon-Tyne Univ. (England). Dove Marine Lab.
F. Evans, and W. Diaz.
Crustaceana, Vol 34, No 3, p 313-315, 1978. 1 fig, 12 ref.

Descriptors: *Environmental effects, *Temperature, Size, Seasonal, Copepods.

The data presented indicate that, in contrast to information available on other copepods, Microstella norvegica is larger in summer than in spring and that its size is directly related to the sea temperature. No explanation of this divergence from the usual pattern of seasonal size in planktonic copepods is given. (Chilton-ORNL)
W79-06498

INTERSPECIFIC AND SEASONAL DIFFERENCES IN THE TEMPERATURE TOLERANCE OF STREAM FISH,
State Univ. of New York Coll. at Buffalo. Dept. of Biology.
K. T. Kowalski, J. P. Schubauer, C. L. Scott, and J. R. Spotila.
Journal of Thermal Biology, Vol 3, No 3, p 105-108, July 1978. 4 fig, 1 tab, 30 ref.

Descriptors: *Environmental effects, *Temperature, Fish, Resistance, Seasonal, Adaptation, Thermal stress, Acclimation.

Interspecific differences in temperature tolerances (CTM) of 13 species of stream fish acclimated to constant temperature (15.0C) and photoperiod (LD 12:12) are reported. Three of these species exhibited seasonal differences in CTM despite acclimation to constant laboratory conditions. Highest CTM was shown by Notropis stramineus at 33.1C. Lowest CTM's were shown by Hypentelium nigricans at 30.8C, Cottus bairdi at 30.9C, and Nocomis micropogon at 30.9C. It was suggested that while CTM is not a precise determinant of the temperature tolerance of fish, it is an indicator of the temperature tolerance and can be used in thermal ecology studies as a measure of the ability of fish to acclimate to changes in temperature. (Chilton-ORNL)
W79-06499

THE BIOLOGY OF THE MARINE SPONGE MICROCIONA PROLIFERA (ELLIS AND SOLANDER). III. SPICULE SECRETION AND THE EFFECT OF TEMPERATURE ON SPICULE SIZE,
Hartford Univ., CT. Dept. of Biology.
T. L. Simpson.
Journal of Experimental Marine Biology and Ecology, Vol 35, No 1, p 31-42, 1978. 10 fig, 2 tab, 23 ref.

Descriptors: *Environmental effects, *Temperature, Aquatic animals, Growth rates, Sponges.

The deposition of silicon in Microciona prolifera is a diversified phenomenon involving a number of different processes with each of three major spicule types being secreted in a different fashion. In these studies, a clear relationship was shown between temperature and silicon deposition. The production of thicker spicules at lower temperatures suggest that the entrapment of transported silicon at the site of polymerization is more efficient at lower temperatures. During the growing season for this intertidal sponge water temperatures generally increase from about 14 to 23C and then decrease to about 16C with the result that spicule secretion within new growth areas is at different temperatures and a range of spicule thickness is seen. Little correlation between spicule length and temperature was found in these studies. (Chilton-ORNL)
W79-06500

5D. Waste Treatment Processes

CLEANING CONTAMINATED GROUND WATER.

Ground Water Age, Vol 13, No 4, p 28-30, December, 1978.

Descriptors: *Water pollution treatment, *Activated carbon, Groundwater barriers, Chemical warfare, Organic pesticides, Colorado, Rocky Mountain Arsenal.

Ground water contamination at the Rocky Mountain Arsenal near Denver, Colorado is being contained by a 1500-foot long underground water barrier and treated with a granular activated carbon system. The treated water is returned to the aquifer on the downstream side of the barrier through a dozen recharge wells. The treatment system's modular design allows for expansion to handle higher flow rates and more stringent water quality requirements in the future. Granular activated carbon's 'broad spectrum' treatment capability provides additional protection against the possible appearance of other dissolved organic contaminants in the ground water. Monitoring wells on both sides of the barrier will keep track of ground water quality and depth. Seasonal variations and changes due modifications in the operation of the treatment system will be studied. This pilot containment/treatment system will provide data needed to design and construct a permanent solution to the problem of contaminated ground water at the Rocky Mountain Arsenal. The techniques employed there will make a significant contribution toward the development of a practical technology for combating ground water contamination. (Purdin-NWWA)
W79-06003

EXPERIMENTS AIMED AT THE REMOVAL OF PHOSPHATE BY ELECTROCHEMICAL METHODS,

Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
E. Dobolyi.
Water Research, Vol 12, No 12, p 1113-1116, 1978. 1 fig, 3 tab, 8 ref.

Descriptors: *Nutrient removal, *Electrochemistry, *Electrolysis, *Phosphates, *Aluminum, *Sewage treatment, Water pollution control, Chemical precipitation, Waste water treatment, Limiting factors, Hydrogen ion concentration, Phosphorus, Nutrients, Research equipment.

Electrochemical dissolution of aluminum is more efficient in removing phosphate from an experimental solution and from sewage than chemical precipitation with an aluminum sulfate solution containing an equal amount of aluminum, if the molar ratio of aluminum to phosphorus is greater than about 1.6. A probably explanation for the higher efficiency of electrolytically produced aluminum ions is that they de-chelate nascent aluminum, as opposed to aqueous solutions where aluminum is already present in the sulfate. In the experiments an electrolysis cell with separated electrode compartments was used to measure in different electrolyte solutions the amount of aluminum dissolved electrochemically in the anolyte by one A current during one min. This was 10-20% greater than that predicted by Faraday's law. The cathode was dissolved chemically, based on alkalinization of the electrolyte in the cathode compartment of the divided cell; the process was unaffected by the current intensity. Sheet aluminum of one mm thickness and 99.99% purity was used for the electodes. Equipment consisted of Plexiglas electrolysis cells, with each compartment having a volume of 1600 cu cm. Four sintered glass filters of G4 pore size separated compartments. Each electrode was submerged to an area of 88 sq cm, and a laboratory stirrer was operated in each compartment. (Lynch-Wisconsin)
W79-06033

ACUTE LETHALITY OF WASTEWATER DISINFECTION ALTERNATIVES TO JUVENILE RAINBOW TROUT (SALMO GAIRDNERI),

Environmental Protection Service, Burlington (Ontario). Waste Water Technology Centre.
V. W. Cairns, and K. Conn.
Research Report No. 92, 1979. 38 p, 4 fig, 10 tab, 22 ref.

Descriptors: *Disinfection, *Chlorination, *Ozone, *Ultraviolet radiation, *Bioassay, Rainbow trout, Dechlorination, Toxicity, Mortality, Waste water treatment, Municipal wastes.

Ninety-six-hour, continuous flow, juvenile rainbow trout bioassays were used to compare the toxicity of secondary municipal effluent before and after disinfection with chlorine, chlorine dioxide, ozone, and ultraviolet light. Non-disinfected secondary effluent was non-acutely lethal in 15 of 17 trials. Ozonated waste water was non-acutely lethal in five of six trials and effluent treated with ultraviolet light was non-acutely lethal in both trials conducted. Mechanical upsets in the treatment systems were responsible for mortalities in the non-disinfected and ozonated effluent trials. The 96-hr LC50's for chlorinated waste water ranged from 0.01-0.09 mg/liter and averaged 0.04 mg/liter as total residual chlorine while chlorine dioxide doses greater than 1 mg/liter produced acute lethality in 96 hrs. Chlorinated effluent was found more toxic than chlorine dioxide disinfection; both disinfected waste waters were non-acutely lethal after dechlorination with sodium sulfite or 24 hrs storage. (Lisk-Firl)
W79-06040

EVALUATION OF HIGH PERFORMANCE LIQUID CHROMATOGRAPHY PACKINGS FOR THE CONCENTRATION AND SEPARATION OF ORGANIC MATERIALS IN WATER,

American Univ., Washington, DC. Dept. of Chemistry.
A. Welebir, W. M. d'Angelo, S. W. Bigelow, and M. H. Aldridge.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A053 652, Price codes: A03 in paper copy, A01 in microfiche. Progress Report, November 28, 1977. 40 p, 7 fig, 5 tab, 44 ref. N00 173-76-C-0183.

Descriptors: *Waste water treatment, *Oil wastes, *Adsorption, *Gas chromatography, *Analytical techniques, Organic compounds, Separation techniques, Water purification, Water treatment, Aqueous solutions, Sea water, Saline water, Biodegradation, Pseudomonas.

The polymeric adsorbent amberlite XAD-4, a copolymer of styrene and divinyl benzene, was studied to determine its efficiency for extracting the dissolved oily wastes from sea water. The purification process required by the XAD-4 material is described. Standards were prepared in distilled water, synthetic sea water, and natural sea water. The adsorption efficiency of the standards from the aqueous solutions was determined by analyzing the solutions with liquid chromatography and aliphatic concentrations by an infrared technique before and after passage through the XAD-4 material. Retention efficiencies of 86 to 88% were obtained. The effects of flow rate, sample size and the weight of XAD-4 on retention efficiency are discussed. In a study for biodegradation by pseudomonas, naphthalene and beta naphthylamine were found to be biodegradable using a qualitative comparative gas chromatographic technique. Both compounds showed end products having the same retention times, suggesting similar mechanisms. Beta-naphthylamine's low biodegradation rate was attributed to the formation of an intermediate which accumulated in solution--the rate determining step. It is concluded that XAD-4 is an excellent trapping agent for trace amounts of organic compounds in water. (Davison-IPA)
W79-06096

WASTEWATER TREATMENT FOR REUSE AND ITS CONTRIBUTION TO WATER SUPPLIES,

District Columbia Dept. of Environmental Services, Washington.
H. P. Warner, and J. N. English.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 145, Price codes: A04 in paper copy, A01 in microfiche. Report No EPA-600/2-78-027, March 1978. 50 p, 7 fig, 20 tab, 11 ref. 68-03-0344.

Descriptors: *Water reuse, *Waste water treatment, *Pilot plants, *Treatment facilities, Potable water, Microorganisms, Organic compounds, Heavy metals, Inorganic compounds, Pesticides, Effluents, Water purification, Water purity, Water quality, Sampling, Radioactivity, Water pollution, Pollutant identification, Water pollution treatment.

The evaluation of a combined biological/physical-chemical pilot treatment system designed to produce a high quality reusable water is summarized. The 18 month study conducted at the EPA/Washington, D. C. Blue Plains Pilot Plant had as objectives: the identification of specific pollutants in the final effluent; an evaluation of individual process performances in removing these pollutants; and the provision of data concerning process and system variability and reliability regarding pollutant removals. Performance results showed the absence of virus in the effluent; concentrations of radioactivity, trihalomethanes and other volatile organics, heavy metals, pesticides, TOC, turbidity, and microbiological constituents were similar to those found in finished drinking waters during the EPA National Organics Reconnaissance Survey in 1975. Specific organic compounds identified in the effluent are also found in finished drinking waters. Result of an 80 element survey did not detect significant quantities of any hazardous inorganic material, and mutagenic properties were not exhibited in effluent organic concentrates. Endotoxin levels were found to be comparable to those of public drinking water supplies. The frequency distribution of the day to day concentrations of chemical, physical, and biological materials remaining in the effluent demonstrated treatment reliability. (Davison-IPA)
W79-06097

EFFECT OF ILLUVIATED DEPOSITS ON INFILTRATION RATES AND DENITRIFICATION DURING SEWAGE EFFLUENT RECHARGE,

Arizona Univ., Tucson. School of Renewable Natural Resources.
R. A. Herbert.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 669, Price codes: A05 in paper copy, A01 in microfiche. Master of Science thesis, 1976. 71 p, 15 fig, 43 ref, 2 append. OWRT A-999-ARIZ(5), 14-34-0001-6003.

Descriptors: *Sewage effluents, *Denitrification, *Infiltration rates, *Recharge, *Ephemeral streams, Sewage, Nitrogen, Groundwater, Sewage disposal, Waste disposal, Sewage treatment, Arizona, Nitrates.

Ephemeral stream channels are used by some southwestern communities for disposal of sewage effluent. One of these communities is Tucson, Arizona. A column study was conducted to determine the interrelationships among nitrogen transformations, infiltration rates, and development of a black layer during sewage effluent recharge. Experiments included the packing of columns with river sand and continuously flooding them with sewage effluent. Infiltration rates and manometer readings were recorded daily and samples of inflow and outflow were collected and analyzed for the various nitrogen compounds. The results are presented. Infiltration rates decreased rapidly upon application of sewage. A black layer developed within a few days, the thickness of which was inversely related to the infiltration rate. There was no apparent relationship between black layer development and reduction in total nitrogen, but most of the nitrogen was in the wrong form for denitrification, making this part of the results inconclusive. The percent of total nitrogen removal was greater for lower infiltration rates. (Jamail-Arizona)
W79-06107

THEORY OF CLARIFIER OPERATION. I. QUIESCENT-HINDERED SETTLING OF FLOCCULATING SLURRIES,
Associated Water and Air Resources Engineers Inc., Nashville, TN.
J. H. Clarke, A. N. Clarke, and D. J. Wilson.
Separation Science and Technology, Vol. 13, No. 9, p 767-789, 1978. 9 fig, 51 ref, 7 tab.

Descriptors: *Clarifiers, *Operation and maintenance, *Mathematical models, Simulation, Flocculation, Separation techniques, Equations, Waste water treatment, Waste treatment, Water pollution treatment, Theoretical analysis, Computer models, Model studies.

The operation of quiescent (batch) clarifiers operating in the Class III mode (hindered settling) with flocculating slurries is simulated by a set of nonlinear partial differential equations, the continuity equations for the individual species of particles. The mathematical model predicts the expected response of the system to variation in input parameters (particle density, viscosity, particle size, clarifier height, percent solids, particle size distribution, and particle disruption rates). Disintegration of the larger particles by viscous drag forces is assumed to be first-order. The equations are integrated numerically for the case of batch settling, and the dependence of settling characteristics on the parameters of the model is studied. (See also W79-06113 and W79-06114) (Witt-IPC)
W79-06112

THEORY OF CLARIFIER OPERATION. II. HINDERED SETTLING OF FLOCCULATING SYSTEMS IN RECTANGULAR CLARIFIERS,
Vanderbilt Univ., Nashville, TN.
D. J. Wilson.
Separation Science and Technology, Vol. 13, No. 10, p 881-893, 1978. 2 fig, 3 ref, 6 tab.

Descriptors: *Clarifiers, *Operation and maintenance, *Mathematical models, Simulation, Flocculation, Separation technique, Equations, Waste water treatment, Waste treatment, Water pollution treatment, Model studies, Theoretical analysis, Computer models.

A mathematical model is presented for describing the steady-state operation of rectangular clarifiers. The model permits the examination of hindered settling of solids which are undergoing flocculation and floc disruption. The steady-state solution requires modest amounts of computer time and also lends itself to the analysis of quiescent settling in jar tests. Assumptions, possible expansions, and limitations of the model are discussed. (See also W79-06112) (Witt-IPC)
W79-06113

THEORY OF CLARIFIER OPERATION. III. SLUDGE BLANKET AND UPFLOW REACTOR-CLARIFIERS,
Vanderbilt Univ., Nashville, TN.
A. N. Clarke, D. J. Wilson, and J. H. Clarke.
Separation Science and Technology, Vol. 13, No. 10, p 895-915, 1978. 19 fig, 4 ref, 1 tab.

Descriptors: *Clarifiers, *Operation and maintenance, *Mathematical models, Sludge, Flocculation, Separation techniques, Equations, Waste water treatment, Waste treatment, Water pollution treatment, Model studies, Theoretical analysis, Computer models, Design.

The operation of three designs of axially symmetric continuous-flow upflow clarifiers is modeled by means of the continuity equations presented earlier. Class III operations (hindered settling) with flocculating slurries is considered, and the larger particles are permitted to disintegrate under the influence of viscous drag forces by a first-order process. The equations are integrated numerically, and the dependence of clarifier performance on clarifier type and hydraulic loadings is explored. Search applications to the design of clarifiers are suggested. (See also W79-06112) (Witt-IPC)
W79-06114

METHOD FOR RECYCLING PAPER MILL WASTE WATER,
For primary bibliographic entry see Field 3D.
W79-06115

ANALYSIS OF SETTLING BASIN OPERATION IN THE PULP AND PAPER INDUSTRY (METSAETEOLLISUUDEN JAETEVESIEN SELKEYTYSALTAAT),
Valtion Teknillinen Tutkimuskeskus, Otaniemi (Finland). Reaktorilaboratorio.
R. Kuoppamaki, E. Ramo, and K. Passinen.
Paperi ja Puu, Vol. 60, No. 11, p 695-698, 701-702, November, 1978. 8 fig, 1 ref, 1 tab. English summary.

Descriptors: *Pulp wastes, *Settling basins, *Operation and maintenance, Pulp and paper industry, Waste water treatment, Effluents, Waste treatment, Water pollution treatment, Water pollution sources, Regression analysis, Optimization, Mathematical studies, Basins, Suspended solids.

In attempting to optimize the operation of pulp and paper industry effluent settling basins, prerequisites are the identification of the pertinent parameters and the quantitative determination of their effects on the solids-removal efficiency. A study was conducted to demonstrate the applicability of statistical methods to the analysis of effluent solids sedimentation. Correlation and regression analyses were used to interpret data from regular basin operating reports and time-series data obtained during a period of intensified basin input and output monitoring. The evaluation of regular report data provided information on the average solids-removal efficiency and its long-term variation. The short-interval multiparamete monitoring data led to conclusions regarding the dynamic characteristics of the basin and gave indications of the relative importance of various parameters to the overall efficiency of the process. The approach outlined seems to offer further developmental potential in data-processing and measurement techniques and has practical utility for improving the solids-removal efficiency of settling basins. (Brown-IPC)
W79-06121

EFFLUENT TREATMENT WITH ION-EXCHANGE RESINS (TRATAMENTO DE EFLUENTES POR RESINAS DE TROCA IONICA),
Rohm and Haas Brazil S.A.
A. Nunes de Oliveira.
O Papel, Vol. 39, p 51-58, August, 1978. 13 fig, 5 ref, 4 tab.

Descriptors: *Pulp wastes, *Waste water treatment, *Ion exchange, Resins, Wastes, Waste treatment, Industrial wastes, Water pollution treatment, Water pollution sources, Pulp and paper industry, Effluents, Economics, Reliability, Kraft mills.

A review is presented of the potential use of ion-exchange resins, such as Amberlite XAD-8, for the treatment of pulp and paper industry effluents. Data are reviewed showing such treatment to be particularly applicable to kraft pulp mill effluents, giving good economy, reliability, and simplicity of operation. The equipment is of compact modular design. The need to match such treatment systems to the individual requirements of a mill is emphasized. (Speckhard-IPC)
W79-06122

A REVIEW OF INDUSTRY EXPERIENCE WITH SELECTED INTERNAL PROCESS SOLIDS SEPARATION DEVICES,
National Council of the Paper Industry for Air and Stream Improvement, Inc., New York.
For primary bibliographic entry see Field 3E.
W79-06123

WATER OF (PAPETERIES DE) VIRGINAL (LES EAUX PROPRES DE VIRGINAL),
C. Platier.
La Papeterie, Vol. 100, No. 11, p 455-456, 458-459, November, 1978. 4 fig, 4 illus.

Descriptors: *Pulp wastes, *Waste water treatment, *Water treatment, Wastes, Industrial wastes, Pulp and paper industry, Effluents, Water pollution treatment, Water pollution sources, Foreign countries, Belgium, Flocculation, Filtration, Sands, Biological treatment, Europe, Waste treatment, Water purification, Treatment facilities, Chemical precipitation.

The process-water and waste-water treatment facilities at a Belgian coated-paper mill, which used 11,000 cu m of water per day, are described. The incoming water is purified by both flocculation and sand filtration. Effluent treatment includes primary flocculation-type clarification and Attisholz-system biological treatment. (Speckhard-IPC)
W79-06124

STUDIES OF FLOCCULATION AND SEDIMENTATION TREATMENT OF PULP MILL EFFLUENT. (PART 2). AN APPROACH OF A CLOSED SYSTEM USING ETTRINGITE COMPOUNDS, (IN JAPANESE),
Oji Paper Col. Ltd., Tokyo (Japan).
T. Horikoshi, O. Ebinuma, Y. Kita, and H. Ishikawa.
Japan Tappi, Vol. 32, No. 9, p 541-547, September, 1978. 8 fig, 9 ref, 2 tab. English summary.

Descriptors: *Pulp wastes, *Waste water treatment, *Flocculation, *Sedimentation, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Pulp and paper industry, Effluents, Calcium hydroxide, Hydrogen ion concentration, Chemical oxygen demand, Lime, Sludge, Silica, Chemical precipitation, Aluminum sulfate, Closed system, Ettringite.

Treatment of pulp mill effluents with Ettringite (prepared by reacting aluminum sulfate with calcium hydroxide at pH 11 or higher) removed COD better than did alum and massive lime dosing. The resulting sedimentation sludge could be used in a closed-system operation. Changes of Ettringite compounds in this closed system were elucidated by x-ray analysis. Interferences by other compounds, such as silica and magnesium oxide, affect the operation of the closed system, and they should be removed. (See also W79-01758) (Brown-IPC)
W79-06127

STUDY OF SULFATE PULP MILL EFFLUENT TOXICITY (ESTUDIO DE LA TOXICIDAD DE LOS EFLUENTES DE UNA FABRICA DE PASTA AL SULFATO),
For primary bibliographic entry see Field 5C.
W79-06128

GENERAL ASPECTS OF WATER POLLUTION BY THE PULP AND PAPER INDUSTRY (ASPECTOS GENERALES DE LA CONTAMIN-

ACION DEL AGUA POR LA INDUSTRIA DE PULPA Y PAPEL),
For primary bibliographic entry see Field 5C.
W79-06130

TREATMENT OF PAPERMAKING EFFLUENTS (TRAITEMENT D'EFFLUENTS DE PAPETERIES),
Societe Rhone Poulenc Textile Progil (France).
B. Ancelle, and S. Lambert.
French Patent No. 2,351,063. Issued December 9, 1977. 8 p. 8 claims.

Descriptors: *Patents, *Pulp wastes, *Waste water treatment, Wastes, Industrial wastes, Pulp and paper industry, Effluents, Waste treatment, Water pollution treatment, Water pollution sources, Bleaching wastes, Flocculation, Ultrafiltration.

A process for treating pulp mill effluents (especially bleach plant effluents) involves addition of a flocculant at a level below that required for proper flocculation and then subjecting the mixture to ultrafiltration. (Speckhard-IPC)
W79-06131

EXPERIMENTAL DECOLORATION OF WASTE WATERS FROM SOFTWOOD KRAFT PULP PRODUCTION (CERCETARI PRIVIND DECOLORAREA APELOR REZIDUALE PROVENITE DE LA FABRICAREA CELULOZEI SULFAT DIN RASINOASE),
M. Puiu, M. Bolohan, and R. Turchevici.
Celuloza si Hirtie, Vol 27, No 2, p 60-68, April/June, 1978. 12 fig, 6 ref, 6 tab.

Descriptors: *Pulp wastes, *Waste water treatment, *Decoloration, *Chemical precipitation, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Pulp and paper industry, Effluents, Color, Aluminum sulfate, Aluminum chloride, Calcium hydroxide, Iron sulfate, Iron chloride, Activated carbon, Lime, Costs, Sludge, Coagulation, Separation techniques, Softwood, Kraft mills.

Among several chemical coagulants investigated in a kraft mill (5% solutions of calcium hydroxide, aluminum sulfate, aluminum chloride, ferric chloride, and ferrous sulfate, as well as activated carbon), the lime treatment was found to give the best results with regard to cost and ease of filtration of the resulting sludge precipitate. (Brown-IPC)
W79-06134

COLOR REMOVAL FROM PULP MILL EFFLUENT USING FLY ASH ACIDIFIED WITH CHLORINATION STAGE EFFLUENT,
Saskatchewan Univ., Saskatoon.
D. N. Rao, N. N. Bakhshi, and D. G. MacDonald.
Canadian Pulp and Paper Association, Transactions of the Technical Section, Vol 4, No 3, p TR77-TR82, September, 1978. 5 fig, 6 ref, 5 tab.

Descriptors: *Decoloration, *Pulp wastes, *Waste water treatment, *Fly ash, *Bleaching wastes, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Pulp and paper industry, Effluents, Aluminum, Iron, Calcium, Ions, Color, Chemical oxygen demand, Hydrogen ion concentration.

Aluminum, iron, and calcium ions are released from fly ash by acidification with the chlorination-stage effluent from a kraft bleach plant. The resulting slurry effectively removes the color from the caustic extraction-stage effluent. One gram of fly ash requires 157 ml of the chlorination-stage effluent to release the maximum amount of metal ions. Treatment of one liter of caustic extraction-stage effluent (color of 36,600 APHA units, COD of 4,220 ppm) with 2.3 g of fly ash acidified with 3.6 liters of chlorination-stage effluent (color of 650 APHA units, COD of 765 ppm) resulted in 93% color and 73% COD removals. The optimum pH for color removal is approximately 4.6. Acidification of fly ash with chlorination-stage effluent is not as effective as with HCl because the effluent pH of 1.64 is not low enough and the dissolved organic compounds in the effluent react with the metal ions. The mechanism of color removal and the behavior of the sludge obtained by this treatment are also briefly discussed. (Swichtenberg-IPC)
W79-06135

AERATED LAGOON TREATMENT OF BLEACHED KRAFT MILL EFFLUENTS AT HIGH TEMPERATURE,
British Columbia Research Council, Vancouver.
E. G.-H. Lee, J. C. Mueller, and C. C. Walden.
Canadian Pulp and Paper Association, Transactions of the Technical Section, Vol. 4, No. 1, p TR15-TR18, March, 1978. 4 fig, 12 ref, 6 tab.

Descriptors: *Pulp wastes, *Waste water treatment, *Aerated lagoons, *Temperature, Wastes, Industrial wastes, Waste treatment, Water pollution sources, Water pollution treatment, Biochemical oxygen demand, Toxicity, Lagoons, Suspended solids, Sludge, Pulp and paper industry, Effluents, Kraft mills.

Laboratory studies suggest that aerated lagoons for treating bleached kraft mill effluents perform satisfactorily up to about 45-50 C. Five-day BOD removal and detoxification efficiency begin to drop when temperatures exceed 50 C. The tendency of mixed liquor suspended solids (biomass) to disperse also increases at temperatures above 50 C, resulting in poor sludge settleability, sludge washout, and high suspended solids levels in effluents. (Switchenberg-IPC)
W79-06136

UTILIZATION OF SPENT SULFITE LIQUOR BY PEKILO FERMENTATION AND ULTRAFILTRATION,
Finnish Pulp and Paper Research Inst., Helsinki.
K. Forss, R. Kokkonen, H. Sirelius, and P.-E. Sagfors.
Canadian Pulp and Paper Association/TAPPI International Sulfite Conference, Montreal, Canada, September 12-14, 1978, Preprinted Proceedings (CPPA Technical Section, Montreal, Quebec, Canada), p 97-102. 11 fig, 3 ref.

Descriptors: *Sulfite liquors, *Waste water treatment, *Ultrafiltration, *Fermentation, Wastes, Industrial wastes, Pulp and paper industry, Effluents, Water pollution treatment, Water pollution sources, Waste treatment, Foreign countries, Europe, Lignins, Lignosulfonates, Industrial water, Proteins.

Protein can be produced from spent sulfite pulping liquors by means of the Pekilo process. A study has been made of the interaction of the Pekilo process with the ultrafiltration process to find possible advantages of their simultaneous application. The results show that fermentation of spent sulfite liquor prior to ultrafiltration permits a reduction in the size of the ultrafiltration installation needed for production of high molecular-weight lignosulfonates, and also diminishes the requirement of wash water, producing a filtrate which is suitable for concentration by hyperfiltration. (Swichtenberg-IPC)
W79-06137

BIOLOGICAL CONTROL ALTERNATIVES FOR A SULFITE MILL (EFFLUENT),
Finnish Pulp and Paper Research Inst., Helsinki.
E. Meloni.
Canadian Pulp and Paper Association/TAPPI International Sulfite Conference, Montreal, Canada, September 12-14, 1978, Preprinted Proceedings (CPPA Technical Section, Montreal, Quebec, Canada), p 81-86. 4 fig, 7 ref, 4 tab.

Descriptors: *Sulfite liquors, *Biological treatment, *Waste water treatment, Pulp wastes, Wastes, Industrial wastes, Water pollution treatment, Water pollution sources, Pulp and paper industry, Effluents, Foreign countries, Europe, Yeasts, Candida utilis, Proteins, Alcohols, Biochemical oxygen demand, Phosphorus compounds, Nitrogen compounds, Capital costs, Operating costs, Costs, Waste treatment, Water pollution control, Finland, Condensates, Sulfite pulp mill, Ethanol, Sulfite alcohol.

Biological treatment and the manufacture of ethanol, Torula (Candida utilis) yeast, or Pekilo protein were evaluated as alternative methods for the pollution control of evaporator condensates from a sulfite pulp mill. All of these processes, with the exception of alcohol manufacture, reduce the organic matter (BOD) discharged from the mill, but increase the discharge of phosphorus and nitrogen. Although biological effluent treatment involves the lowest capital and operating cost, it remains the most expensive alternative, since the other methods yield a saleable product. (Swichtenberg-IPC)
W79-06138

PILOT PLANT STUDIES OF BIOLOGICAL TREATMENT OF MAGNESIUM-BASE SULFITE MILL EFFLUENT--AERATED STABILIZATION BASIN AND ROTATING BIOLOGICAL SURFACE,
Ontario-Minnesota Pulp and Paper Co., Ltd., Fort Frances.
C. D. Baker, R. H. Nachbar, and R. E. Summer.
Canadian Pulp and Paper Association/TAPPI International Sulfite Conference, Montreal, Canada, September 12-14, 1978, Preprinted Proceedings (CPPA Technical Section, Montreal, Quebec, Canada), p 69-80. 4 fig, 12 ref, 3 tab.

Descriptors: *Sulfite liquors, *Waste water treatment, *Biological treatment, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Pulp wastes, Pulp and paper industry, Effluents, Foreign countries, Canada, Biochemical oxygen demand, Aerated lagoons, Oxidation lagoons, Nutrients, Suspended solids, Sludge, Lagoons, Newsprint mills, Spent sulfite liquor, Rotating biological contactor.

Magnesium-base spent sulfite liquor (SSL) was pretreated with aqueous ammonia and phosphoric acid and biologically treated in an aerated stabilization basin (ASB) at loadings of 4 and 12 lb BOD/1000 cu ft/day for retention periods of 20 and 7 days, respectively. This 2-yr study was carried out at a Canadian integrated newsprint mill during both summer and winter months. BOD reductions were satisfactory. The influence of nutrients on BOD reduction was determined. Basin suspended solids were higher at the shorter residence time. Column settleability tests showed that about 50% of the effluent solids were readily settleable but upflow rates less than 625 gal/day-ft would be needed to remove most of the solids. Filter leaf tests revealed that the settled solids would be difficult to dewater on a vacuum filter. It was concluded that BOD reduction in an ASB is feasible but solids clarification and sludge dewatering make the process impractical. Similar studies on the BOD reduction of SSL were conducted with a rotating biological contactor (RBC). Although BOD reductions of over 80% were achieved on occasion, the overall performance of the unit was erratic. Because the unit had an integral clarifier, sludge settleability was not adequately characterized. The settled sludge showed wide variations in its characteristics. The RBC performance was very sensitive to fluctuations in feed properties. (Swichtenberg-IPC)
W79-06139

ASSESSMENT OF THE ABILITY OF BIOLOGICAL TREATMENT TO DETOXIFY EFFLUENTS FROM SULFITE MILLS PRACTICING CHEMICAL RECOVERY,
Beak Consultants Ltd., Montreal (Quebec).
S. Schneiderman, and G. A. Allard.
Canadian Pulp and Paper Association/TAPPI International Sulfite Conference, Montreal, Canada, September 12-14, 1978, Preprinted Proceedings (CPPA Technical Section, Montreal, Quebec, Canada), p 49-58. 12 ref, 16 tab.

Descriptors: *Pulp wastes, *Sulfite liquors, *Waste water treatment, *Biological treatment, Detoxifica-

tion, Wastes, Industrial wastes, Water pollution treatment, Toxicity, Water pollution sources, Waste treatment, Pulp and paper industry, Effluents, Activated sludge, Aerated lagoons, Biochemical oxygen demand, Operation and maintenance, Design, United States, Chemical recovery, Spills, Sulfite pulp mills.

According to a survey of seven U.S. sulfite pulp mills, aerated lagoon systems and activated sludge treatment are capable of effluent detoxification irrespective of the form of chemical recovery. Four of the 7 treatment systems detoxified irrespective of the form of chemical recovery. Four of the 7 treatment systems detoxified 100% of the time; the remaining 3 mills exhibited lesser degrees of detoxification frequency. BOD removal was generally good, ranging from 73 to 91%, except at two mills where the BOD removals were 45 and 60%. Proper design and operation and frequency and duration of liquor spill strongly affect the ability of biological treatment to detoxify sulfite mill effluents. No consistent relationship was found between pulping base or wood species and detoxification. (Swichtenberg-IPC)
W79-06140

PURIFICATION OF HIGH-ASH WASTEWATERS IN FLOTATION SAVEALLS (OCHISTKA VYSOKOZOL'NYKH STOCHNYKH VOD NA FLOTATSIONNYKH LOVUSHKAKH),
Vsesoyuznyi-Nauchnyi Planovii Otdel Bumazhnoi Promyshlennost, Moscow (USSR).
V. A. Kopylov.
Bumazhnaya Promyshlennost', No. 10, p 28-29, October, 1978. 2 fig, 1 tab.

Descriptors: *Pulp wastes, *Waste water treatment, *Flotation, Wastes, Pulp wastes, Industrial wastes, Water pollution treatment, Waste treatment, Water pollution sources, Pulp and paper industry, Effluents, Aeration, Water purification, Suspended solids, White water(Paper machines), Savealls, Aluminum oxide, Polyacrylamide, Rosin.

A study of ways to increase the efficiency of flotation savealls, so that they can be used for treatment of white water from the manufacture of high-ash content papers, showed that the air can be utilized more effectively when the tank inlet is located tangentially near its bottom; the height of the head tank should not exceed 10-12 m. A further increase of saveall efficiency can be achieved by the addition of chemical agents (aluminum oxide, polyacrylamide, and rosin size) in doses depending on the suspended solids content. With a combination of these chemicals, a degree of purification of up to 99% was obtained for effluent containing up to 4,800 mg/liter of suspended solids. (Stapinski-IPC)
W79-06142

OXIDATIVE TREATMENT OF INDUSTRIAL WASTEWATER,
Industrial Environmental Research Lab.-Cincinnati, Edison, NJ.
F. Ellerbusch, and H. S. Skovronek.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 268, Price codes: A02 in paper copy, A01 in microfiche. Technical Report EPA-600/J-77-057. 1977. 9 p, 7 fig, 3 tab, 55 ref.

Descriptors: *Industrial wastes, *Oxidation, *Waste treatment, *Performance, *Costs, Oxidation lagoons, Activated sludge, Incineration, Aerated lagoons, Ozone, Electrolysis.

Oxidative industrial waste treatment processes are defined, categorized, and discussed. Biological, chemical, and thermal methods, categorized as oxidative destruction, reductive destruction, and nondestructive, separation processes, are considered. Advantages, disadvantages, and generalized cost comparisons are presented. Energy use or production is also considered. US Environmental Protection Agency projects are identified as examples. Some systems discussed include activated sludge, sludge incineration, multiple oxidation channels, oxidation pond, aerated lagoon, and the PACT system. Ozone treatment of electroplating wastes, alkaline oxidation pulping, and electrolytic oxidation of plating wastes, are outlined. (Small-FIRL)
W79-06144

PROCESSING RAW SEWAGE BY ULTRAFILTRATION,
David W. Taylor Naval Ship Research and Development Center, Bethesda, MD.
L. R. Harris, and C. M. Adema.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 607, Price codes: A02 in paper copy, A01 in microfiche. Report MAT-77-79. April 1977. 15 p, 2 fig, 5 tab, 25 ref.

Descriptors: *Filtration, *Membranes, *Membrane processes, *Sewage effluents, *Water quality standards, Water pollution, Waste water treatment, Waste water disposal, Suspended solids, Coliforms.

Four filtration configurations were evaluated for the treatment of raw sewage to produce effluent which meets discharge regulations for marine sanitation devices. One microfiltration unit and nine ultrafiltration systems were operated and four filtration configurations were tested: tubular, hollow fiber, spiral wound, and plate and frame. Pretreatment and cleaning requirements for each system were assessed. Parameters evaluated for each system included relative flux decline, maintenance, rejection of fecal coliforms, and removal of suspended solids. The 1980 effluent discharge standard requires that waste water contain <150 mg/liter of suspended solids and <200 fecal coliform bacteria per 100 ml. All the systems investigated produced an effluent which met the suspended solids limitations and all but two systems produced effluent that met the coliform requirements. Further research with non-cellulosic tubular membranes with a 1-inch interior diameter and with hollow fiber membranes in conjunction with a biological oxidation system was recommended. Comparison of these systems with a plate and membrane design was also suggested. (Lisk-FIRL)
W79-06146

CONTROL OF VIRUS PATHOGENS IN MUNICIPAL WASTEWATER AND RESIDUALS BY IRRADIATION WITH HIGH ENERGY ELECTRONS,
New Hampshire Univ., Durham. Dept. of Microbiology.
T. G. Metcalf.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 347, Price codes: A04 in paper copy, A01 in microfiche. 1977. 64 p, 18 fig, 2 tab, 19 ref.

Descriptors: *Radiation, *Waste water treatment, *Disinfection, *Viruses, *Sewage treatment, Performance, Seasonal, Water pollution.

Electron radiation was used to disinfect waste water based on inactivation of enteric viruses. Trials with an in-line installed radiation unit at the city of Boston's Municipal Waste Treatment Plant on Deer Island confirmed results obtained at the High Voltage Research Laboratory, MIT. Radiation doses needed for disinfection were calculated from D(10) values determined for test enteric viruses and natural virus numbers found per unit volume of a vwaste water residual. Disinfection of fresh raw sewage was estimated to require at least 400 kilorads/ml doses. As much as 600 kilorads/ml may be required during the summer months, based on peak concentrations of 1000 PFU/ml. Disinfection of waste water effluents was estimated to require a maximum of 400 kilrads/gal. Acid adjustment of a residual pH 3.7 or addition of aluminum or ferric chlorides, enhanced radiation effectiveness. Also, a method was developed for recovery of test virus from large volumes of digested sludge which permitted recoveries of 50% of test virus incorporated into five gal samples. (Small-Firl)
W79-06148

ALUM ADDITION AND STEP-FEED STUDIES IN OXYGEN-ACTIVATED SLUDGE,
Department of Environmental Services, Washington, DC.
D. F. Bishop, J. A. Heidman, R. C. Brenner, and J. B. Stamberg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 892, Price codes: A03 in paper copy, A01 in microfiche. Report EPA-600/2-77-166, 1977. 31 p, 6 fig, 10 tab, 10 ref.

Descriptors: *Activated sludge, *Oxygen requirements, *Performance, *Suspended solids, *Phosphorus, Lime, Municipal wastes, Sludge treatment.

A plug flow, oxygen-activated sludge process was operated with alum addition to remove phosphorus and with lime addition to prevent the process pH from decreasing below 6.4. The pollutant removals from the primary effluent ranged from 82 to 92% for BOD (7.4 to 19 mg/liter of residual BOD), from 52 to 84% for suspended solids (17 to 56 mg/liter of residual suspended solids), and from 54 to 86% for phosphorus (1.05 to 3.26 mg/liter of residual P). Optimum P removal occurred at a 1.8 to 1 average Al/P ratio with an average total residual P of 1.05 mg/liter. In the second phase of the study, the oxygen-activated sludge process was operated in a step-feed configuration consisting of a sludge oxygenation stage followed by three stages of oxygen aeration with equal portions of the primary effluent fed to each stage. The step configuration clearly reduced the solids loading to the clarifier and provided an average process MLSS of more than 6500 mg/liter. Excellent BOD removal was realized with the step operation. Eighty-nine percent removal from the primary effluent resulted with an effluent BOD of 10 mg/liter and a soluble filtered effluent of less than 3 mg/liter. The COD and suspended solids residual averaged 43 mg/liter and 23 mg/liter, respectively. Oxygen usage in the step configuration was significantly less than the 90% typically achieved in co-current contacting. (Small-FIRL)
W79-06149

ACTIVATED CARBON TREATMENT OF KRAFT BLEACHING EFFLUENTS,
Saint Regie Paper Co., Cantonment, FL.
E. W. Lang, J. W. Stephens, and R. L. Miller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 078, Price codes: A04 in Paper copy: A04 in paper copy, A01 in microfiche. Report EPA-600/2-77-119, 1977. 54 p, 12 fig, 6 tab, 12 ref, append.

Descriptors: *Pilot plants, *Activated carbon, *Color, *Organic matter, *Bleaching wastes, Pulp and paper industry, Pulp wastes, Costs, Performance, Adsorption.

A pilot plant study investigated the removal of color and organic contaminants from kraft pulp bleaching plant effluent by adsorption in activated carbon. The caustic bleach effluent, which contains 80% of the color from pulp bleaching, was decolorized when pH was adjusted to 2.5. The spent carbon could be regenerated with caustic solution for an average of 11 adsorption-regeneration cycles before thermal regeneration was necessary. The pH of feed, feed rate, effluent from bleaching of hardwood and softwood, caustic requirements for regenerating the carbon, and concentration of color in feed, were studied. The process was technically sound. It can remove 94% of the color and 84% of the total organic carbon from caustic bleach effluent from the bleaching of softwood. Capital and operating cost estimates are presented for full-scale plants. Variations in design and their cost effects are discussed. The process is generally more expensive than alternative processes for reducing color such as resin adsorption, ultrafiltration, or bleach sequence modification. (Small-Firl)
W79-06151

POWDERED ACTIVATED CARBON ADDITION AT THE WOODSTOCK WATER POLLUTION CONTROL PLANT,

Gore and Storrie Ltd., Toronto (Ontario).
T. Alkema, and R. Luscombe.
Ministry of the Environment, Ontario Technical Report E.01. 1978. 20 p, 1 fig, 7 tab.

Descriptors: *Activated carbon, *Waste water treatment, *Granules, *Pilot plants, *Performance, Biochemical oxygen demand, Color, Oxidation, Ammonia.

A pilot plant study of the effectiveness of powdered activated carbon (PAC) addition to the secondary treatment section at the Woodstock Water Pollution Control Plant was conducted. PAC was added daily to both plant aeration cells. A sampling and analysis program determined the impact of the PAC addition over an 18 wk period. Good operating results were obtained. No significant improvement in BOD removal was found. PAC had no impact on heavy metal removal. Color removal in the secondary treatment section as much improved with PAC addition. Also, oxidation of NH3-N was improved. This increased ammonia removal which was important at this particular plant because a large percentage of the effluent TOD is normally contributed by the nitrogenous oxygen demand. (Small-Firl)
W79-06152

CHARACTERISTICS OF EFFLUENTS FROM SEPARATE SEPTIC TANKS TREATING GREY WATER AND BLACK WATER FROM THE SAME HOUSE,
Ontario Ministry of the Environmental, Toronto. Pollution Control Branch.
M. Brandes.
Technical Report W 68, 1977. 32 p, 3 fig, 6 tab, 30 ref.

Descriptors: *Waste water treatment, *Septic tanks, *Domestics wastes, Sludge, *Performance, Sewage, Coliforms, Phosphorus, Nitrogen, Soil filters.

The chemical and bacteriological characteristics of septic tank effluents from two separate tanks used by one house for grey water and black water (toilet) treatment were studied for nine months. The household used only phosphorus free detergents. For the grey water septic tank effluent, the concentrations of total phosphorus and total Kjeldahl nitrogen were 1.4 and 11.3 mg/liter, respectively. These values are about 10 times lower than the toilet waste water septic tank effluent. Total and fecal coliform organisms in the grey water septic tank were higher than in the effluent from the toilet septic tank. Grey water levels were 24,000,000 and 1,400,000 ml, respectively. The effect of soil filters on removal of chemical and bacteriological contaminants from the septic tank effluents is discussed. Sludge accumulation rates were determined: 8.3 liters/person/yr for the grey water tank and 65.7 liters/person/yr for the toilet water septic tank. Grey water septic tank cleaning were about 8 to 10 times less frequent than recommended time intervals for normal household septic tanks. (Small-FIRL)
W79-06161

NITRIFICATION OF A SECONDARY MUNICIPAL EFFLUENT USING A ROTATING BIOLOGICAL CONTACTOR,
Ontario Ministry of the Environment, Toronto. Waste Water Treatment Section.
T. Hewitt.
Research Publication 71, 1978. 41 p, 11 fig, 6 tab, 25 ref, 1 append.

Descriptors: *Municipal wastes, *Nitrification, Rotational flow, *Mechanical equipment, Hydraulics, Aerobic bacteria, Oxidation, *Ammonia, *Aerobic treatment, Waste water treatment, Performance.

The feasibility of using the Rotating Biological Contactor (RBC) process for biological nitrification of a non-nitrified, secondary municipal effluent was evaluated. Tests were conducted in both summer and winter in Ontario which established that the RBC process could produce a consistent, well-nitrified effluent. During summer tests, nitrification efficiency decreased as hydraulic loading was increased from 0.8 Imperial gpd/sq ft to 3.2 Imperial gpd/sq ft. A hydraulic loading of 3.2 Imperial gpd/sq ft produced an effluent of 0.77 mg/liter average NH3-N, with 71% of the effluent samples containing less than 1 mg/liter NH3-N. As disc rotational speed increased from 1 rpm to 2 rpm, nitrification efficiency increased. During winter, at constant hydraulic loading, nitrification efficiency decreased as waste water temperature decreased. A hydraulic loading rate of 2.4 Imperial gpd/sq ft produced an effluent of 1.05 mg/liter average NH3-N with 79% of the effluent samples containing less than 2 mg/liter NH3-N. Total recovery of nitrification was limited and recovery time was lengthy after two successive upsets. (Small-FIRL)
W79-06162

THE RELATION OF SOIL CHARACTERISTICS TO THE FAILURE OF DOMESTIC WASTE-WATER DISPOSAL SYSTEMS,
Vermont Univ., Burlington.
F. R. Magdoff.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 809, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Center Technical Completion Report, April 1979. 46 p, 11 fig, 11 tab, 26 ref. OWRT A-025-VT(1).

Descriptors: *Waste water disposal, *Septic tanks, Soil clogging, Mound systems, Clay soils.

Laboratory and field experiments were conducted to assess design criteria and performance of mound systems for septic tank effluent disposal on clay soils. Laboratory experiments indicated that the mound fill might clog if high rates of effluent application are used (greater than 3 cm/day) or the height of fill is insufficient to allow for well oxidized conditions near the infiltrative surface of the fill. Thirty centimeters of fill or more appear necessary to reduce the development of clogging. Clogged surfaces could recover infiltrative capacity if they were allowed to rest under aerobic conditions. Field experiments clearly showed the superiority of mound systems to subsurface disposal, especially during wet years. Moisture tension patterns in the fill of mound systems indicated that while during the winter clogging of the infiltrative surface may begin, summer conditions appear to cause a recovery of the infiltrative capacity. At no time was seepage noted around the experimental mound systems.
W79-06165

COST ESTIMATES FOR CONSTRUCTION OF PUBLICLY-OWNED WASTEWATER TREATMENT FACILITIES, 1976 NEEDS SURVEY. VOLUME 1,
Environmental Protection Agency, Washington, DC. Office of Water Program Operations.
J. A. Chamblee.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 717, Price codes: A05 in paper copy, A01 in microfiche. Report 430/9--76--010, 1977. 62 p, 41 tab, append.

Descriptors: *Costs, *Waste water treatment, *Public utilities, Sewers, Infiltration, Storm runoff, Overflow, Rehabilitation.

Cost estimates are presented for needed publicly-owned waste water treatment facilities as part of a report to Congress. Eight categories are covered: Secondary treatment, Higher than secondary treatment, Correction of infiltration/inflow, Major rehabilitation of sewers, New collector sewers, New interceptor sewers, Control of combined sewer overflow, and Treatment and/or control of stormwaters. EPA's assessment of the need for construction of municipal wastewater treatment facilities to serve 1990 populations is $95.9 billion in categories 1-5, and an additional $54.1 billion for control of stormwaters. The states' estimate for the same needs are $100.4 billion for the first five categories and $57.2 billion for stormwaters control. (See also W79-06324) (Small-FIRL)
W79-06323

COST ESTIMATES FOR CONSTRUCTION OF PUBLICLY-OWNED WASTEWATER TREATMENT FACILITIES. VOLUME 2. SUMMARIES OF TECHNICAL DATA CATEGORIES I-IV. 1976 NEEDS SURVEY,
Environmental Protection Agency, Washington, DC. Municipal Construction Div.
J. A. Chamblee.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 718, Price codes: A05 in paper copy, A01 in microfiche. Report 430/9--76-011, 1977. 81 p, 8 fig, 26 tab, 2 append.

Descriptors: *Costs, *Waste water treatment, *Public utilities, Sewers, Infiltration, Storm runoff, Overflow, Rehabilitation.

Technical data are presented from the 1976 Needs Survey for Waste Water Treatment Facilities as a supplement to the Cost Estimate Report to Congress. Categories of needs include: Secondary treatment and best practicable waste water treatment technology, More stringent treatment, Infiltration/inflow correction, Sewer system replacement or major rehabilitation, New collectors and appurtenances, New interceptors and appurtenances, Correction of combined sewer overflow, and Treatment and/or control of stormwater. (See also W79-06323) (Small-FIRL)
W79-06324

DEWATERING SEWAGE SLUDGE BY ELECTRO-OSMOSIS. PART 1. BASIC STUDIES,
Electricity Council Research Centre, Capenhurst (England).
J. G. Sunderland.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 411, Price codes: A03 in paper copy, A01 in microfiche. Report, 1976. 26 p, 6 fig, 7 tab, 7 ref, 1 append.

Descriptors: *Electro-osmosis, *Sludge treatment, *Dewatering, *Electrodes, *Polymers, Sewage sludge, Design criteria, Performance, Municipal wastes.

The thickening of sewage sludge by electro-osmosis on a continuous basis was found feasible in laboratory-scale experiments. Sewage sludge from an anaerobic digester was used in the study and contained about 3% solids. The types of dewatering apparatuses tested included: a cylindrical cell with horizontal parallel electrodes, a dipped cell configuration, a rotating drum cell, and a moving belt cell. Applied voltage ranged from 10-30 volts at pumping rates which varied from 1.92-11.4 ml/min. Employing a fixed and a moving polymer mesh belt (1 cm/15-20 sec) at pumping rates of 4.0-5.2 ml/hr/sq cm, a final solids content of 26-28% was achieved. Currents applied ranged from 3.0-5.6 amps; power requirements correlated closely with the initial solids content of the sludge. The laboratory experiments indicated there would be no problems with scale-up of the electro-osmosis dewatering procedure. Polymer mesh belts drawn across static vertical cathodes were considered feasible on a commercial-plant scale. (See also W79-06326) (Lisk-FIRL)
W79-06325

DEWATERING SEWAGE SLUDGE BY ELECTRO-OSMOSIS. PART II SCALE-UP DATA,
Electricity Council Research Centre, Capenhurst (England).
D. Ellis, and J. G. Sunderland.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 412, Price codes: A02 in paper copy, A01 in microfiche. Report 1977. 25 p, 7 fig, 6 tab, 2 ref.

Descriptors: *Dewatering, *Sewage treatment, *Electro-osmosis, *Performance, *Costs, Electrodes, Design, Biochemical oxygen demand, Chemical oxygen demand, Sanitary engineering.

A project scale rig for the electro-osmotic dewatering of sewage was constructed. The moving belt and vertically disposed electrodes minimize floor area requirements and permit continuous removal

of solids from the electrode surface, eliminating batch operation. The rate of dewatering and hence the current can be maintained essentially constant, at constant voltage. A sewage cake of about 24% solids was achieved, together with effluent low in COD and BOD. Cost comparisons are made between different methods of sludge dewatering. Electrokinetic costs are related to initial solids concentration, and compare favorably with conventional techniques at and above about 8% initial solids. The process is probably not appropriate for the sewage treatment market, although much of the technology is relevant to the dewatering of other materials such as ball clay. (See also W79-06325) (Small-FIRL)
W79-06326

ADVANCED TREATMENT APPROACHES FOR METAL FINISHING WASTEWATERS. PART I,
Industrial Environmental Research Lab.-Cincinnati, Edison, NJ.
H. S. Skovronek, and M. K. Stinson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-277 147, Price codes: A02 in paper copy, A01 in microfiche. Report EPA-600/J-77-056a, 1977. 8 p, 12 fig, 1 tab, 27 ref.

Descriptors: *Industrial wastes, *Metallurgy, *Water pollution sources, *Ion exchange, *Electrolysis, Evaporation, Adsorption, Pilot plants, Chromium, Zinc, Nickel, Copper.

New technologies for the control, recycle, and destruction of water pollutants generated in the electroplating and related industries, are described. Ion exchange, evaporation, cementation, electrolytic processes, advanced chemical techniques, treatment of fluoborates, carbon adsorption, and starch xanthate, are discussed. Results of industrial and EPA pilot tests are presented. Pollutants being controlled are primarily: cyanide, chromium, zinc, nickel, and copper. An ion exchange process to recover aluminum from phosphoric acid waste generated by bright finishing of aluminum parts, is described, as is the Reciprocating Flow Ion Exchange method. An electrolytic technique based on semiconductive beds of carbon particles for the reduction of hexavalent chromium and the oxidation of cyanides, was evaluated. Advanced chemical techniques include the Kastone process with zinc recovery, and the Sulfex process. (See also W79-06328) (Small-FIRL)
W79-06327

ADVANCED TREATMENT APPROACHES FOR METAL FINISHING WASTEWATERS PART II,
Industrial Environmental Research Lab.-Cincinnati, Edison, NJ.
H. S. Skovronek, and M. K. Stinson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-277 148, Price codes: A02 in paper copy, A01 in microfiche. Report EPA 600/J-77-0566 1977. 5 p, 8 fig, 1 tab, 46 ref.

Descriptors: *Industrial wastes, *Water pollution sources, *Reverse osmosis, *Electrodialysis, *Membrane processes, Separation techniques, Solvent extractions, Freezing, Costs, *Performance, Sludge treatment.

New technologies for the control, recycle, and destruction of water pollutants generated in the electroplating and related industries, are described. Reverse osmosis, electrodialysis, newer membrane techniques, solvent-based systems, and freezing are considered. The advantages of reverse osmosis techniques include low capital cost, low space requirements, and low labor costs. Results of EPA tests with three new membranes were encouraging for PA-300, PBIL, and NS-100. A successful application of electrodialysis to nickel recovery is related as is unsuccessful attempt to recover cyanide. Donnan dialysis is being developed and shows promise in chromate and copper treatment. The ZDS system is described which utilizes a combination of countercurrent rinsing and displacement by immiscible fluids to separate dissolved chemicals from rinse water, is described. Freezing is discussed as a possible future treatment method. Control options for sludge are considered briefly. (See also W79-06327) (Small-FIRL)
W79-06328

EVALUATION OF A VAPOR COMPRESSION DISTILLATION UNIT FOR LAUNDRY WASTEWATER REUSE,
Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
J. J. McCarthy, and R. H. Chyrek.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A045 765, Price codes: A03 in paper copy, A01 in microfiche. Technical Report 7711. 1977. 44 p, 10 fig, 10 tab, 6 ref.

Descriptors: *Recycling, Waste water treatment, *Distillation, Domestic water, *Laundering, Testing, *Performance, *Mechanical equipment, Water quality, Energy, Maintenance.

A nominal 6 gph vapor compression distillation unit (VCDU) built by Chemtric, Inc. of Rosemont, IL, was evaluated using laundry waste water. Product water quality and energy use rates were determined, and operation and maintenance were monitored for a 16 wk period. Product water quality from the laundry waste water feed when compared with tap water was lower in turbidity, total solids, and conductivity, but higher in total organic carbon and chemical oxygen demand. When all heat was supplied solely by vapor compression, there was minimum energy use. Use of the storage tank heater caused maximum energy use. In actual operation, use of the storage tank heater averaged 655 watt/hr/gal of water produced. Energy use rates were generally high because of intermittent unit operation, lack of adequate operator controls, and severe maintenance problems. Energy use requirements were elevated by poor heat transfer conditions caused by varying water levels and convective currents in the sump and storage tanks. Operation of the VCDU was stopped when foam from the concentrated waste water began to carry-over into the product water in spite of a foam entrainment control medium. When foam carry-over became consistent, product water quality deteriorated rapidly. (Small-FIRL)
W79-06329

CONCEPTUAL DESIGN OF A PILOT WASTEWATER IRRADIATION FACILITY,
Army Facilities Engineering Support Agency, Fort Belvoir, VA.
C. Everline.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A047 788, Price codes: A07 in paper copy, A01 in microfiche. Final Report, 1977. 226 p, 36 fig, 21 tab, 1 append.

Descriptors: *Irradiation, Radiation, *Waste water treatment, *Sewage treatment, *Pilot plants, *Design, Microorganisms, Sampling.

The design of a pilot waste water irradiation treatment plant is presented and discussed. To determine the effects of gamma irradiation on all phases of sewage treatment, the facility should be connected to an operating waste plant in such a manner that influent sewage can be sampled as well as primary, secondary, and tertiary effluent. Initial waste water composition will be analyzed for microbe concentration, surfactants, phenols, dissolved oxygen, and free chlorine. In the mixing and holding tank, the sewage could be chemically treated before irradiation. Irradiation time will be limited by a flow meter, and a recycle loop can be utilized. All effluent will be passed through a radiation monitor before being discharged. Plant layout and radiological protection are described, as are peripheral equipment design and source selection. Nuclear design of the irradiator is also described. (Small-FIRL)
W79-06333

TOXICOLOGICAL INVESTIGATIONS OF PILOT TREATMENT PLANT WASTEWATERS AT HOLSTON ARMY AMMUNITION PLANT,
Battelle Columbus Labs. Columbus, OH.
J. M. Stilwell, M. A. Eischen, W. L. Margard, M. C. Matthews, and T. B. Stanford.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A042 601, Price codes: A04 in paper copy, A01 in microfiche. Final Report July 27, 1977. 46 p, 11 fig, 11 tab, 28 ref, 2 append.

Descriptors: *Chemical wastes, *Trickling filters, *Activated sludge, *Toxicity, *Biological treatment, Lethal limit, Industrial wastes, Chemical oxygen demand, Nutrients, Waste water treatments, Pilot plants, Bioassay, Chemical analysis.

Several waste waters from effluent streams at the Holston Army Ammunition Plant were treated in an activated sludge chamber or in a trickling filter followed by activated sludge treatment; treated effluent was subjected to 96-hour acute LC50 bioassay tests with fathead minnows to determine toxicity. The pilot plant tests were conducted on two effluent streams mixed in a ratio of 1:9 by volume; one effluent sample was composed of waste water from 10 effluent sources while the second was a mixture of four samples plus synthetic wastes added to increase the COD to 400 mg/liter. The wastes were either treated by the activated sludge method or passed through a trickling filter prior to activated sludge treatment. Bioassay tests were conducted for each individual waste water, the mixture of both effluents, effluent from the activated sludge treatment, and effluent from the combined treatment. The toxic effects of the waste waters were correlated with high levels of HMX, COD, BOD, pH, NH3, TKN, PO4, NO2 and total solids. LC50 values of the first waste stream indicated it was the most toxic at a value of 1%. The second effluent had LC50 values ranging 6.2-43.8% while the combined wastes has LC50 values from between 1.43-14.0%. The treated waste water exhibited significantly lower toxicity, with LC50 values of >70%. The levels of RDX in the effluents were not considered toxic in the bioassay tests. Biological treatment of ammunition waste waters was considered suitable for reducing toxicity. (Lisk-Firl)
W79-06334

THE ROLE OF SEWAGE LAGOONS AT CORPS OF ENGINEERS RECREATION AREAS,
Army Engineering Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
T. D. Hand, and R. R. Williams.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A047 833, Price codes: A04 in paper copy, A01 in microfiche. Final Report 1977. 55 p, 6 tab, 66 ref, append.

Descriptors: *Sewage lagoons, *Performance, *Seasonal, Design, Recreation, Aerated lagoons, Sewage treatment, Algal control.

The role of Corps of Engineers recreation area sewage lagoons was assessed by reviewing current technology and current Corps needs. A literature review was conducted to determine design, operation, and upgrading methods which could be applicable to the special loading problems and other characteristics of recreation area sewage lagoons. Also, a survey established the geographic distribution and the design and performance successes and failures of the 200 lagoons. Facultative lagoons were well suited to seasonal recreation areas. Mechanical aeration can be used to upgrade overloaded lagoons. Anaerobic lagoons were not useful for this application. Where annual evaporation exceeds precipitation, total retension lagoons were successful. In northern areas, controlled discharge was effective, but this needs to be developed in warm, humid areas. Phase isolation seems to be a promising development, but it has not been evaluated sufficiently. Effective methods for removing algal solids are reviewed. Most Corps lagoons are operating at hydraulic and organic loads far below design levels. (Small-Firl)
W79-06335

UTILITY DISTRIBUTION SYSTEMS IN ICELAND,
Army Terrestrial Sciences Center, Hanover, NH.
For primary bibliographic entry see Field 8A.
W79-06337

DECONTAMINATION OF WATER CONTAINING CHEMICAL AND RADIOLOGICAL WARFARE AGENTS BY REVERSE OSMOSIS,
Army Mobility Equipment Research and Development Command, Fort Belvoir, Va. Energy and Water Resources Lab.
D. C. Lindsten, and P. R. DesRoches.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A046 203, Price codes: 04 in paper copy, A01 in microfiche. Report June 1977. 66 p, 16 fig, 31 tab, 1 append.

Descriptors: *Chemical wastes, *Radioactive wastes, *Reverse osmosis, *Membranes, *Potable water, Sea water, Brackish water, Water pollution, Cesium, Iodine, Strontium, Chemical warfare, Water pollution sources, Waste water treatment, Water treatment, Separation techniques.

Performance tests were conducted on a reverse osmosis water purification unit with two types of membranes for treating polluted fresh water, sea water, brackish water, and water contaminated with chemical, biological, and radiological agents. The model unit was a 600 gal/hr Reverse Osmosis Water Purification Unit for producing potable water. The membranes compared were a dry, modified, brackish-water type cellulose acetate membrane and a sea water type polyamide membrane. The chemical agents were GB, VX, and BZ while the radiological agents were iodine-131, strontium-85, and cesium-134. The polyamide membrane was found to be superior to the cellulose acetate membrane, although both were effective in the removal of turbidity, conductivity, color, alkalinity, hardness, and dissolved solids from raw water. The polyamide membrane removed more than 99% of the chemical contaminants and removed 95.5% of the iodine-131, 99.7% of the strontium-85, and 98.8% of the cesium-134, on the average. The polyamide membrane was not, however, able to consistently reduce the levels of the chemical and radiological contaminants in the water to within the maximum permissible concentration (MPC). A post, activated carbon column to treat the permeate from the reverse osmosis unit and further research of the treatment process were recommended. (Lisk-FIRL)
W79-06340

LAND TREATMENT OF WASTEWATER AT WEST DOVER, VERMONT,
Army Terrestrial Sciences Center, Hanover, NH.
For primary bibliographic entry see Field 5E.
W79-06341

FINAL EIS GREENSBORO-GUILFORD COUNTY, N.C. 201 WASTEWATER TREATMENT SYSTEM PROJECT NO. C37037601.
Environmental Protection Agency, Atlanta, GA. Region IV.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 694, Price codes: A19 in paper copy, A01 in microfiche. Report EPA 904/0-77-037. 1977. 445 p, 8 fig, 7 tab, 5 append.

Descriptors: Waste wate treatment, Sewage treatment, *North Carolina, *Streams, *Environmental effects, Terrestrial habitats, *Tertiary treatment, Sewers, Air pollution effects, Odor, *Environmental Impact Statement.

This environmental impact statement was prepared in response to the awarding of a grant to the city of Greenboro, NC, for the purpose of developing a waste water treatment system to service about 36 mgd of waste water for the Greensboro-Guilford County area. The proposed action consisted of upgrading an existing plant to teriary treatment at 16 mgd, abandoning one plant, and building a new 20 mgd plant with tertiary treatment. Direct adverse environmental impacts were minor. They included sewer construction and plant construction causing short-term stream siltation and increased airborne particulate, destruction of some natural vegetation, temporary noise levels that exceed acceptable thresholds, and reduced flow in a segment of Buffalo Creek. Potential secondary adverse impacts include possible flooding and erosion, continued terrestrial habitat attrition, and increased air pollution due to population increases. Beneficial impacts include meeting the effluent limits for the creeks, elimination of an odor source, and allowance for planning orderly urban growth while minimizing urban sprawl. Seven alternatives are presented. (Small-FIRL)
W79-06345

DRAFT ENVIRONMENTAL IMPACT STATEMENT. HENDERSON, NORTH CAROLINA, 201 WASTEWATER TREATMENT SYSTEM.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-261 095, Price codes: A14 in paper copy, A01 in microfiche. 1976. 181 p, 48 fig, 41 tab, 70 ref.

Descriptors: *Waste water treatment, *Municipal wastes, Odors, Phosphorus, *Environmental effects, Water quality, Bodies of water, North Carolina, *Water pollution sources, *Environmental Impact Statement.

Three alternative waste water treatment systems to service the Greater Henderson area were developed. The major environmental impacts associated with the water quality downstream of the waste water treatment plant discharges are described. Using Alternative A, the Red Bud Creek treatment plant would be abandoned, the existing Nutbush Creek plant would be upgraded to a capacity of 1.58 mgd with odor controls and phosphorus removal, and a 2.12 mgd plant would be constructed on Sandy Creek. Alternative A would cause moderate adverse impacts on Sandy Creek, a substantial improvement in Nutbush Creek water quality, and a moderate increase in Kerr Reservoir water quality. Using Alternative B, the Red Bud Creek plant would be abandoned and a new 3.7 mgd plant would be constructed on Sandy Creek. This alternative would cause major improvement in Nutbush Creek water quality and a moderate adverse impact on Sandy Creek. Using Alternative C, The Red Bud Creek plant would be abandoned and the Nutbush Creek plant would be upgraded or expanded to 3.7 mgd with phosphorus removal and odor controls. This alternative would cause a substantial increase in the water quality of Nutbush Creek and Kerr Reservoir. (Small-FIRL)
W79-06346

MANAGEMENT OF METAL-FINISHING SLUDGE,
E. P. Crumpler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 946, Price codes: A04 in paper copy, A01 in microfiche. Report EPA/530/SW-561 1977. 62 p, 8 fig, 2 tab, 31 ref.

Descriptors: *Sludge treatment, *Sludge disposal, *Recycling, Chemical precipitation, Metallurgy, *Industrial wastes, Reverse osmosis, Ion exchange, Solvent extractions, Electrodialysis.

The state-of-the-art technology for the management of metal-finishing sludge is discussed. Disposal techniques, recycle and waste reduction technology are reviewed. The major advantages and disadvantages of each technique are presented, along with current EPA research and demonstration efforts. Environmentally adequate disposal technology includes encapsulation, heat treatment, chemical lining of disposal cells, and chemical fixation. Water treatment processes which produce nonhydroxide sludge include sulfide precipitation and starch xanthate precipitation. Internal recycle of rinse water dragout includes evaporative recovery, reverse osmosis, ion exchange, electrodialysis, freeze separation, solvent rinsing, and ion floatation. External recovery of segregated metals from sludges and solutions includes integrated treatment, Kastone treatment process, single metal sludge recovery, and spent bath recovery. Recovery of metals from mixed hydroxide sludges includes solvent extraction and electrochemical roasting. (Small-FIRL)
W79-06347

IN SITU TREATMENT OF HAZARDOUS MATERIAL SPILLS IN FLOWING STREAMS,
Battelle-Northwest, Richland, WA.
G. W. Dawson, B. W. Mercer, and R. C. Parkhurst.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-274 455, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/2-77-164. October 1977. 49 p, 16 fig, 8 tab, 9 ref.

Descriptors: *Activated carbon, *Chemical wastes, *Adsorption, *Running waters, *Application methods, Granules, Porous media, Treatment, Waste water treatment, Water pollution, Disasters, Water treatment, Separation techniques.

Buoyant activated carbon and porous fiber bags packed with granular activated carbon were compared for treating, in situ, chemical wastes from spills in flowing streams. Tests were conducted in a renovated irrigation ditch carrying water at flow rates between 3.98-4.45 cu ft/sec spiked with 4 lb methylisobutyl ketone (hexone), 1 lb of methanol, and 0.1 lb of rhodamine dye to simulate hazardous chemical wastes. Buoyant activated carbon was added by sub-surface and surface introduction to the waste flow and subsequently recovered by conventional skimming techniques. The non-buoyant packaged carbon bags were attached to floats and allowed to flow with the spill plume for a distance before manual removal. Flow rates of the waste water were varied in the irrigation channel which had a quiescent section. Buoyant carbon was superior to the carbon-filled bags, achieving 50% waste removal at carbon to contaminant ratios of 10:1; carbon recovery exceeded 90%. Containment removal by the porous bags was directly related to turbulence and current structure in the receiving water body, achieving 20% removal at a flow rate of 15 cu ft/sec. Up to 25% of the bags were lost due to snagging and shore capture. The bags were considered easier to handle and steam stripping was suitable for regenerating the hexone. An air deliverable slurry injection system was recommended for introduction of buoyant carbon and further investigations of the treatment methods were recommended. (Lisk-FIRL)
W79-06348

INDUSTRIAL WASTEWATER RECIRCULATION SYSTEM: PRELIMINARY ENGINEERING,
Owens-Corning Fiberglas Corp., Toledo, OH.
A. W. Loven, and J. L. Pintenich.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 990, Price codes: A09 in paper copy, A01 in microfiche. Report EPA-600/2-77-043, 1977. 150 p, 61 fig, 33 tab.

Descriptors: *Industrial wastes, *Recycling, *Waste water treatment, Filtration, *Performance, Activated carbon, Disinfection, Reverse osmosis, *Pilot plants.

Various technologies for a closed-loop, industrial waste water system were tested on a pilot plant scale at a fibrous glass plant. Sand filtration, activated carbon adsorption, and disinfection methods were tested and found to yield water suitable for reuse. If removal of inorganic dissolved solids is required, it can be accomplished through treatment by reverse osmosis or lime-soda softening/anion exchange. Complete physical and chemical treatment of fibrous glass plant wastes is not feasible due to extreme residual concentrations of non-adsorbable organic compounds. Construction of a full-scale plant is planned. The projected design loadings for advanced waste water treatment processes are: Flow = 285 gpm; TSS loading = 31 lb/day; and TOC loading = 116 lb/day. (Small-FIRL)

W79-06349

FEASIBILITY STUDY ON IN-SEWER TREATMENT METHODS,
Pomeroy, Johnston and Bailey, Pasadena, CA.
R. D. Pomeroy, and R. J. Lofy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 445, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-77-192 1977. 106 p, 16 fig, 10 tab, 22 ref, 2 append.

Descriptors: *Waste water treatment, *Sewers, Biochemical oxygen demand, *Oxygen, Activated sludge, Flocculation, Flow, Slopes, Sewage treatment.

Biological, chemical, and physical methods of in-sewer waste water treatment are discussed. Promise is seen in biological oxidation which leads to a partial reduction of BOD. An appreciable reduction of BOD occurs normally in sewers. Equations are developed which can estimate this oxidation. A high degree of treatment requires an adequate oxygen supply, and oxidizing culture, and time. The culture could be suspended in the form of activated sludge or attached to solid surfaces. Possible methods for supplying oxygen are discussed. The prospects for a useful degree of in-sewer treatment are good for force mains. Under certain limited conditions, a sewer can function as an efficient flocculation device in conjunction with chemical treatment. Slope-flow relationships in most sewers produce velocity gradients suitable for flocculation of aluminum hydroxide and iron hydroxide. (Small-FIRL)
W79-06350

APPRAISAL OF POWDERED ACTIVATED CARBON PROCESSES FOR MUNICIPAL WASTEWATER TREATMENT,
Battelle-Northwest, Richland, WA.
A. J. Shuckrow, and G. J. Culp.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 933, Price codes: A16 in paper copy, A01 in microfiche. Report EPA-600/2-77-156, 1977. 340 p, 27 fig, 137 tab, 44 ref, 1 append.

Descriptors: *Activated carbon, *Sewage treatment, Activated sludge, Nitrification, *Evaluation, *Costs, Performance, *Granules, Municipal wastes.

All work with powdered activated carbon (PAC) and PAC regeneration was reviewed, and representative processes were compared with activated sludge, activated sludge with nitrification, and granular activated carbon. No one PAC approach was superior from a performance point of view. Biophysical processes were attractive because they can be incorporated into existing biological plants. Capital and operating costs were compared for plants with throughput rates of 1, 5, 10, 25, and 50 mgd. Independent physical-chemical PAC systems were not economically competitive with other modes of treatment. PAC can offer advantages for specific cases where highly variant flows are experienced such as plant receiving flows of a seasonal nature or areas with combined storm sewer systems. Possible improvements which could make PAC competitive were investigated. Lower carbon doses and/or inexpensive throwaway carbon are necessary to make the system competitive with the other systems evaluated. (Small-FIRL)
W79-06352

CONTROL OF REFINERY VACUUM PRODUCING SYSTEMS, WASTEWATER SEPARATORS AND PROCESS UNIT TURNAROUNDS,
Environmental Protection Agency, Research Triangle Park, NC. Office of Air Quality Planning and Standards.
K. C. Hustvedt, and R. A. Quaney.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 662, Price codes: A03 in paper copy, A01 in microfiche. Report EPA-450/2-77-025, October 1977. 40 p, 4 fig, 5 tab, 40 ref.

Descriptors: *Air pollution, *Oil industry, *Organic compounds, *Oil wastes, *Separation techniques, Oily water, Maintenance, Economics, Gases, Vapor pressure, Volatility.

The technology, impacts, regulations, and economics of controlling volatile organic compound (VOC) emissions from vacuum producing systems, waste water separators, and process unit turnabouts in petroleum refineries are discussed. VOC emissions from vacuum producing systems may be controlled by passing non-condensable vapors to a fire-box, incinerator, or to a compressing system. Waste water separator emissions may be minimized by covering forebays and separator sections; types of covers suitable for these areas are described. Process unit turnabouts, such as shutdowns, repairs, inspections, and start ups, may incorporate systems where vapors are added to the fuel gas system, flared, or vented to the atmosphere; VOC emissions will be minimized if vapors are combusted with fuel gas or flared until the pressure in the vessel is close to atmospheric pressure. An economic analysis of control systems considers all the technical parameters used in developing control costs. The impacts of these emission control technologies on energy and the environmental are discussed briefly. Regulatory aspects reviewed include the identification of plants to which regulations would apply, the selection of an appropriate format, and recommendations for compliance and monitoring techniques. (Lisk-FIRL)
W79-06355

AUTOMATIC EXCHANGE RESIN PILOT PLANT FOR REMOVAL OF TEXTILE DYE WASTES,
Bennett Coll., Greensboro, NC.
A. Maggiolo, and J. H. Sayles.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 362, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/2-77-136. 1977. 54 p, 18 fig, 5 tab, 7 ref, 1 append.

Descriptors: *Resins, *Adsorption, Waste water treatment, *Dyes, *Industrial wastes, *Cost comparisons, Automation, Capital costs, Recycling, Solubility, Laboratory tests.

Adsorption resins were used to remove colored dyes from textile dyeing waste waters using an automated bench-scale pilot unit. This method could make possible the reuse of treated waste waters in subsequent dyeing operations at competitive costs. At a waste water treatment rate of 20,000 gpd by resin adsorption, the amortized operating cost was estimated at $3.47/1000 gal. Capital investment was estimated at $86,000. Operating costs for alternative processes, ozonation, carbon treatment, and hyperfiltration (reverse osmosis) are $1.90, $1.00, and $2.00/1000 gal, respectively, on a one million gpd rate of operation. These costs would equal or exceed the estimated costs for the resin adsorption process when scaled down to the typical 20,000 gpd dispersed dye hosiery plant basis. Adsorption resins have the advantage of removing insoluble dispersed dyes from waste water. The three alternative processes effectively remove soluble dyes, but not much is known about their effectiveness in removing insoluble dyes. Insoluble dyes are non-responsive to biological waste treatment. (Small-FIRL)
W79-06356

BENEFICIAL DISPOSAL OF WATER PURIFICATION PLANT SLUDGES IN WASTE-WATER TREATMENT,
North Marin County Water District, Novato, CA.
J. O. Nelson, C. A. Joseph, and R. L. Culp.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-285 230, Price codes: A03 in paper copy, A01 in microfiche. Report EPA-600/2-78-089, 1978. 33 p, 2 fig, 6 tab.

Descriptors: *Water purification, Sludge treatment, *Activated sludge, Waste water treatment, Municipal wastes, Sewers, Chemical oxygen demand, Biological oxygen demand, Phosphorus, *Sludge digestion, *Solid wastes, Settling velocity, Costs.

The effects and costs of discharging alum sludge from a municipal water clarification plant into a sanitary sewer system and activated sludge sewage treatment plant, were investigated. The addition of the alum sludge caused the following changes. The efficiency of primary settling decreased about 10%, while the efficiencies of COD and BOD removals were unchanged. Phosphorus removal was improved by 12%, and scum removal and sludge settling improved. The capacity of centrifuges for sludge dewatering was increased 12 to 50%. Digester gas production increased partially because of improved mixing of digester contents. A slight improvement was noted in final effluent turbidities. There were no observed adverse effects on overall plant performance. (Small-FIRL)
W79-06361

ODOR ASSESSMENT FOR SEWAGE SLUDGE SAMPLES 300A01002,
Battelle Pacific Northwest Labs., Richland, WA.
D. B. Cash, and P. M. Molton.
Available from the National Technical Information Service, Springfield, VA 22161 as BNWL-2177, Price codes: A05 in paper copy, A01 in microfiche. Report BNWL-2177, December 1976. 90 p, 44 fig, 13 tab, 2 append.

Descriptors: *Odor, *Sewage sludge, *Sludge treatment, *Irradiation, *Sludge digestion, Gas chromatography, Heat treatment, Analytical techniques, Pollutant identification, Sewage treatment.

Dilution-to-threshold tests were performed to assess the odor levels in digested and undigested sewage sludge treated with a combination of irradiation and heat. Changes in the odor of the sludges were evaluated over a seven day period. Treated and untreated undigested sewage sludge and treated and untreated digested sludge demonstrated significant odor transformations over the seven day testing period. Treated undigested sludge had a stronger odor than untreated undigested sludge. All samples demonstrated a pattern in which odor increased to a maximum threshold odor number, followed by a slight decrease in odor; the samples, however, did not reach the maximum threshold odor number on the same day. Treated digested sewage sludge had a stronger odor than untreated digested sludge and attained a maximum threshold odor number of 683,000. Untreated digested sludge had a maximum odor level of 190,000. Components of sewage volatiles identified by gas chromatography demonstrated a time dependent variation, attaining distinct maximums after two to four days of exposure to air. The individual peaks obtained for sewage volatiles by gas chromatography were considered potential indicators for measuring odor strength of undigested sewage sludge. The influence of two peaks on a third peak that was considered an odoriferous component was not determined. (Lisk-FIRL)
W79-06364

BREAKING EMULSIONS IN NAVY BILGE COLLECTION AND TREATMENT SYSTEMS,
Naval Research Lab., Washington, DC.
R. C. Little, and R. L. Patterson.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A033 649, Price codes: A04 in paper copy, A01 in microfiche. Memorandum Report 3424, 1976. 51 p, 9 tab, 22 ref, 1 append.

Descriptors: *Ships, *Waste water treatment, Oily water, *Seepage, *Emulsions, Pilot plants, *Coations, Water pollution sources, Oil pollution.

Laboratory and field tests were conducted of a new bilge waste water collection and treatment system which serves as the collector, transporter, and gravity separator for ship's bilge waste. A class of cationic demulsifiers was identified which met performance requirements. The waste oil ref was an acceptable vehicle for oil-in-water emulsion breaking operations when mixing methods for the

demulsifier are adequate. A pilot plant study of demulsifier effectiveness for oil-in-water emulsions in waste oil rafts is recommended to gain the widest possible field experience. The use of cationic agents in shore-based only waste treatment plants should also be considered. (Small-FIRL)
W79-06368

EVALUATION OF OZONATION AND CHLORINATION FOR DISINFECTION OF BLACKWATER,
Abcor, Inc., Wilmington, MA. Walden Div.
K. J. McNulty, and R. L. Goldsmith.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A033 734, Price codes: A05 in paper copy, A01 in microfiche. Final Report December 1976. 89 p, 43 fig, 6 tab, 13 ref.

Descriptors: *Chlorination, *Ozone, *Disinfection, *Ships, *Waste water, Hydrogen ion concentration, Temperature, Coliforms, Operating costs, Capital costs.

Disinfection tests on marine vessel blackwater compared ozonation and chlorination at various concentrations, temperatures, and pH's for reducing fecal coliform levels to 200 colonies/100 ml. Experiments focused on ozone or chlorine dosages required at temperatures of 15C and 30C and pH ranging from 5-9. Ozonation was unaffected by temperature and pH while the required chlorine dosage appeared to increase with temperature and pH (at 30C). The variation in blackwater samples was cited as a possible reason for the increase in chlorine requirements. Results of the disinfection study indicated that an ozone dosage of 750 mg/liter was required to attain the desired fecal coliform level while a chlorine concentration of 240 mg/liter was necessary. An economic analysis of the two treatment methods determined that operating and capital costs for the ozonation system were three times greater than the costs for a chlorination system. Ozonation, however, was considered to have the advantages of better viricide action and no production of chlorinated hydrocarbons. (Lisk-FIRL)
W79-06370

ENZYME TECHNOLOGY FOR SHIPBOARD WASTE MANAGEMENT,
David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.
L. R. Harris, and A. E. Lardis.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A033 730, Price codes: A03 in paper copy, A01 in microfiche. Technical Report 76-0117, 1976. 28 p, 5 tab, 38 ref.

Descriptors: *Enzymes, *Ships, Oil pollution, *Oily water, *Waste water treatment, Water pollution sources, Odor cleaning.

Current enzyme technology and applications were reviewed, and areas were identified where enzymes may provide solutions to shipboard waste management problems. Enzyme characteristics were discussed including enzyme kinetics, reactors, and immobilization, and current applications are reviewed. Waste water treatment methods being considered by the Navy include utilization of a packed bed immobilized enzyme system, an enzyme cellulase process, enhancement of UF performance using enzymes, and detoxifying organotin compounds. Enzymes systems are also being considered for odor control, cleaning operations, oil pollution control and analytical monitoring. Research and development recommendations are made including development of a shipboard waste water treatment system based on immobilized enzyme technology, and determination of the feasibility of adding enzyme/bacterial products for controlling oil discharges from ballast tanks. (Small-FIRL)
W79-06372

HIGHLIGHTS OF RESEARCH ON OVERLAND FLOW FOR ADVANCED TREATMENT OF WASTEWATER,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
C. R. Lee, P. G. Hunt, R. E. Hoeppel, C. A. Carlson, and T. B. Delaney.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A033 864, Price codes: A03 in paper copy, A01 in microfiche. Technical Report Y-76-6, 1976. 24 p, 9 fig, 4 tab, 17 ref.

Descriptors: Tertiary treatment, *Municipal wastes, Waste water treatment, *Overland flow, Slopes, *Heavy metals, *Nitrogen, *Phosphorus, Performance.

Greenhouse grass-soil models were used to study the overland flow treatment of municipal waste water. The response of overland flow treatment of nitrogen, phosphorus, and heavy metals to various operating conditions was determined. Overland flow was an efficient nitrogen removal method. Up to 99% nitrogen removal was obtained at a 2% slope with an application period of either 6 or 18 hr. Phosphorus removal was about 80 to 84% when 0.5 inch/acre of waste water was applied to a 2% slope in either 6 or 18 hr. Waste water flowing over the soil does not have extensive contact with iron and aluminum compounds in the soil that fix massive amounts of phosphorus. Heavy metal removal was greater than 90% when 0.5/inch/acre of waste water was applied in 6 hr on a 2% slope. Overland flow systems require extensive construction, a suitable cover crop, waste water storage during cold weather, and a flow rate no greater than 0.5 inch/acre/day. (Small-FIRL)
W79-06373

LABORATORY RESULTS OF LAUNDRY WASTEWATER TREATMENT,
Army Facilities Engineering Support Agency, Fort Belvoir, VA. Research and Technology Div.
M. Botros, and W. C. Best.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A039 603, Price codes: A04 in paper copy, A01 in microfiche. Report FESA-RT-2017, 1976. 49 p, 13 fig, 5 tab, 3 ref.

Descriptors: Laundering, *Domestic wastes, Waste water treatment, *Recycling, *Coagulation, *Flocculation, Sulfates, *Filtration, Filters, Cost analysis.

A laboratory investigation was conducted of the chemical treatment of laundry waste water using different coagulation and flocculation compounds. When ferric chloride was used, sodium hydroxide and WT-2700 (1 flocculation aid) were used which increased costs and required a complicated treatment design. When aluminum sulfate and lime were used, water hardness increased. The use of Al2(SO4)3 alone gave good results, and the use of Al3(SO4)3 with polyelectrolyte WT-2700 gave excellent results. Good flocculation was obtained in a pH range of 5.5-6.5 and a temperature range of 25-35C with flow turbidity. Filtration was also discussed including the design of the ideal sand filter, the use of polymers as a filtration aid, and types of filter structures. The recycling of laundry wastewater at army installations would not be cost effective. (Small-FIRL)
W79-06375

COUNTERCURRENT RINSING ON A HIGH-SPEED HALOGEN TINPLATING LINE,
National Steel Corp., Weirton, WV. Weirton Steel Div.
D. A. Pengidore.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 590, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-600/2-77-191, 1977. 94 p, 19 fig, 4 tab, 6 ref, 1 append.

Descriptors: *Waste water treatment, *Industrial wastes, *Recycling, *Metallurgy, Chemicals, Steel, Metals.

The first use of countercurrent rinsing on a high speed plating line was investigated. The operating performance of the multistage rinse system was studied to determine whether or not the basic principles of countercurrent rinsing would hold. Also, the best method for recovering the chemicals in the concentrated stream from this rinse system were determined. Also described are efforts to recycle the concentrated rinse back into the main plating system. The problems encountered in the direct recycle may be solved by a new technique in removing sodium ions from the rinse stream or the main bath. Plans are underway to recover the tin values from the dragout recovery system by sending the rinse solution to the Detinning Plant. Full recovery of fluorides and other constituents at the Detinning Plant is also under investigation. (Small-FIRL)
W79-06381

REPORT ON THE PLANT EVALUATION AT OLD FAITHFUL WASTEWATER TREATMENT PLANT YELLOWSTONE NATIONAL PARK,
Environmental Protection Agency, Denver, CO. Region VIII.
O. K. Boe, and L. Malloy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-277 743, Price codes: A02 in paper copy, A01 in microfiche. Report EPA-908/3-77-004, 1977. 10 p, 2 fig, 1 tab.

Descriptors: *Activated sludge, Aeration, Sewage, *Waste water treatment, *Nitrification, *Temperature, Settling basins, Nitrogen.

Observations and process control data obtained at the Old Faithful 0.51 mpg activated sludge waste water treatment plant were assessed by the EPA. The high temperature of the waste water was a critical factor which influenced all phases of operation. Warm sewage seemed to cause nitrification in the plant even though the facility was not designed to nitrify. Settleometer tests indicated the formation of extensive gas bubbles, probably nitrogen, which caused excessive floating of sludge in both the settlometer and the clarifier. Recommendations are made to reduce the degree of nitrification. A carefully controlled sludge wasting program should be established during start up, and the system may need to operate at less than design hydraulic detention times. The final clarifier should operate to minimize sludge detention times. One or more of the reaeration basins may be used as an N2 stripping basin. Process control tests and data analyses should be continued to further process control analyses. (Small-FIRL)
W79-06382

INVESTIGATION OF THE FEASIBILITY OF TERTIARY TREATMENT OF MUNICIPAL WASTEWATER STABILIZATION POND EFFLUENT USING RIVER WETLANDS IN MICHIGAN,
Williams and Works, Grand Rapids, MI.
J. C. Sutherland.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 283, Price codes: A08 in paper copy, A01 in microfiche. Report, 1977. 164 p, 11 fig, 1 tab, 5 append.

Descriptors: Feasibility, *Wetlands, *Tertiary treatment, *Municipal wastes, Waste water treatment, Capital costs, *Michigan, Rivers, Energy, *Streams.

The engineering feasibility of using Michigan river wetlands for tertiary treatment of municipal waste water stabilization pond effluent was investigated as an alternative to upland spray irrigation and chemical tertiary treatment. An aerial reconnaissance was made of 75 Michigan Southern Peninsula rural municipalities with populations ranging from 360-2800 which utilized treatment ponds and had proximal streams. Thirty-five to 40% of these were estimated to have suitable wetlands. The method could yield capital cost savings totalling about $320,000 (1977 dollars) when used instead of upland irrigation, and about $150,000 when used instead of chemical treatment. Interaction with the Wisconsin Department of Natural Resources indicated interest in the wetlands treatment method for municipal application. The wetland method is esti-

mated to be the most cost effective when pond-wetland distance is less than four miles. Favorable capital cost advantages include anticipated low land cost and minimum of on-site hardware. Also, operational energy requirements would be low. (Small-FIRL)
W79-06383

THE FEASIBILITY OF ESTABLISHING OPERATIONAL WATER HYACINTH-BASED SYSTEMS AT THE TREATMENT FACILITIES OF EXISTING CITIES,
Caspan Corp., Houston, TX.
F. C. Urteaga.
Available from the National Technical Information Service, Springfield, VA 22161 as N78-14947, Price codes: A04 in paper copy, A01 in microfiche. Final Report, 1977. 51 p, 12 tab, 4 ref.

Descriptors: *Municipal wastes, Groundwater, *Sewage lagoons, *Water hyacinth, Waste water treatment, Florida, Texas, Costs, Regulation, *Feasibility, Cities.

The feasibility of establishing operational water hyacinth treatment facilities at three South Florida and two South Texas communities of 20,000 residents or less, was investigated. Florida cities were not responsive and were generally unsuited to the suggested treatment system. The Florida Department of Environmental Regulation discourages the use of stabilization ponds and surface discharge. This is because of South Florida's very high groundwater table and the fact that treatment facilities had already reached advanced planning stages. South Texas communities, on the other hand, were excellent candidates for water hyacinth treatment because of current treatment systems, regulatory philosophy, stage of planning to meet permit requirements, and economic conditions. Stabilization ponds which could be converted, are common. Up-grading current facilities would, however, require financial assistance. (Small-FIRL)
W79-06384

VIRAL AND BACTERIAL AEROSOLS AT A WASTEWATER SPRAY IRRIGATION SITE,
Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
H. T. Bausum, S. A. Schaub, and K. F. Kenyon.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-054 436, Price codes: A03 in paper copy, A01 in microfiche. Technical Report 7804, 1976. 37 p, 2 fig, 14 tab, 14 ref.

Descriptors: *On-site tests, *Spraying, *Aerosols, Waste water, Microorganisms, *Aerobic bacteria, Fluorescent dye, *Tracers, Model studies, Viruses.

The second phase of a field study to measure microbiological aerosol dissemination by the spray irrigation mode of land waste water application was conducted at Ft. Huachuca, AZ. Bacterial and virus aerosols were sampled after spraying chlorinated and unchlorinated secondarily treated waste waters during periods of high and low sunlight intensity. Predictions were attempted of long distance migration and aerosol dispersal of total aerobic bacteria and enteric virus using seeded coliphage f2 as a model. In some runs, the waste water was seeded with sodium fluorescein dye to estimate physical aerosol decay. In chlorinated effluent, aerobic bacteria averaged 240,000 cfu/mg (standard plate count). One hundred and fifty m downwind of the sprayer, bacterial aerosol levels were as high as 9900/cu m at 46 m. Downwind levels were inhanced by darkness or low solar radiation. Chlorination at about 6 mg/liter reduced waste water effluent bacterial levels 3300-fold, and reduced bacterial aerosols to near background levels at all distances. Fluorescein dye aerosol levels remained somewhat higher in relation to source strength than bacterial levels, providing an indication of the extent of early bacterial die-off. Source strength and meteorological date were used in conjunction with a dispersion model to generate mathematical predictions of aerosol strength at each sampler location. Ratios of predicted aerosol strength to observed strength ranged from 308 to 1661. (Small-FIRL)
W79-06385

EVALUATION OF MEMBRANE SEPARATION PROCESSES, CARBON ADSORPTION, AND OZONATION FOR TREATMENT OF MUST HOSPITAL WASTES,
Abcor, Inc., Wilmington, MA. Walden Div.
A. Z. Gollan, K. J. McNulty, R. L. Goldsmith, M. H. Kleper, and D. C. Grant.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A030 057, Price codes: A20 in paper copy, A01 in microfiche. Final Report, 1976. 437 p, 80 fig, 53 tab, 33 ref, 11 append.

Descriptors: Waste water treatment, *Reverse osmosis, *Adsorption, *Ozone, Membranes, *Filtration, *Hospitals, Organic matter.

The development of a compact 4000 gpd waste system to process non-sanitary wastes at a MUST army field hospital was investigated. Processes evaluated included waste equalization, ultrafiltration (UF), reverse osmosis (RO), and post treatment. A treatment sequence of waste equalization, UF, RO, O3, ion exchange, and Cl2 produced an effluent suitable for reuse. This treatment sequence also produced satisfactory discharge effluent for laundry composite wastes but not for laboratory wastes. This treatment sequence also produced potable water from brackish surface waters. A process design was developed for a system capable of operating in either the reuse mode or the waste-treatment/water-treatment mode. The system satisfies all quality specifications except for laboratory wastes. When operating on laboratory wastes, the system will have a reduced output capacity because of the organic content of the laboratory waste RO permeate exceeds the treatment capabilities of the ozonation system. (Small-FIRL)
W79-06386

5E. Ultimate Disposal Of Wastes

CLEANING CONTAMINATED GROUND WATER.
For primary bibliographic entry see Field 5D.
W79-06003

ECONOMIC ASSESSMENT OF FGD SLUDGE DISPOSAL ALTERNATIVES,
Tennessee Valley Authority, Muscle Shoals, AL.
J. W. Barrier, H. L. Faucett, and L. J. Henson.
Journal of the Environmental Division, American Society of Civil Engineers, Vol 104, No 5, p 951-966, October 1978. 13 tab, 25 ref.

Descriptors: *Sludge disposal, *Flue gas desulfurization, *Electric powerplants, *Waste disposal, *Alternative costs, Alternative planning, Slurries, Lime, Landfills, Ponds, Tennessee Valley Authority, Sulfur dioxide, Fly ash, Scrubbers, Economics, Costs, Coals, Chemfix process, IUCS process, Dravo process, Untreated ponding, Untreated sludge-fly blending, Gypsum.

Evaluation of six disposal processes for flue gas desulfurization (FGD) sludge indicated that in all case variations the gypsum option required the lowest capital investment and annual revenue requirement. The six alternatives were: (1) untreated ponding, (2) Dravo process, (3) IU Conversion Systems process, (4) Chemfix process, (5) untreated sludge-fly ash blending, and (6) gypsum. FGD systems are being installed in coal-fired steam-generator electric power plants to meet federal emission standards, to remove sulfur dioxide before flue gas is discharged in the atmosphere. Some 90% of systems employ scrubbing with lime or limestone slurry, resulting in reaction products requiring disposal. This report is based on option assessments made by the Tennessee Valley Authority. Conclusions: (1) gypsum requires a much smaller equipment investment than other options except untreated ponding, which requires a very expensive disposal pond; (2) altenatives involving pond disposal (untreated and Dravo) require the highest capital investments (all other processes involve landfill disposal); (3) processes using chemical treatment (Dravo, IUCS, and Chemfix) had higher annual revenue requirements than the other three; (4) both unit capital investment and unit revenue requirements were slightly lower for large plant sizes; and (5) capital and revenue requirements vary almost directly in proportion to quantify of sludge. Other factors included remaining plant life, distance to disposal site, and type of transport. (Lynch-Wisconsin)
W79-06041

LAND MANAGEMENT OF SUBSURFACE-INJECTED WASTEWATER LIQUID RESIDUALS,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
J. L. Smith, M. H. Lutkin, J. S. Latham, and A. de Haai.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 162, Price codes: A03 in paper copy, A01 in microfiche. Interim Report, 1977. 44 p, 6 fig, 3 tab, 8 ref, 1 append.

Descriptors: *Pilot plant, *Ultimate disposal, *Irradiation, Kansas, *Disinfection, Sewage treatment, *Waste water treatment, Costs, Injection wells, Landfills.

Recommendations are made for the construction and operation of a Proof-of-Concept Experiment facility adjacent to the sewage treatment plant at Lawrence, Kansas. The objectives of the POCE were: to determine the acceptability of irradiation disinfection and subsurface injection as an alternative technology for current methods of stabilization and handling waste water residuals; and, to define specific operational characteristics and economics of irradiation disinfection and subsurface injection as a technology for the treatment of waste water residuals. The optimum configuration of treatment facilities utilizing irradiation disinfection and subsurface injection was to be determined. Also, the environmental effects of subsurface injection of irradiation disinfected residuals, were to be investigated. Potential benefits of this research are reduced treatment costs, simplification of treatment facilities, and preparation of a better and safer product for land application. (Small-FIRL)
W79-06331

FEASIBILITY STUDY OF VACUUM FILTRATION SYSTEMS FOR DEWATERING DREDGED MATERIAL,
Ryckman, Edgerley, Tomlinson, and Associates, Inc., St. Louis, MO.
B. W. Long, and D. J. Grana.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A053 773, Price codes: A09 in paper copy, A01 in microfiche. Technical Report, 1978. 169 p, 57 fig, 9 tab, 8 ref, 2 append.

Descriptors: *Filtration, *Dredging, *Dewatering, *Waste disposal, Particle size, Coagulation, Separation techniques, Lime, *Performance.

The feasibility of dewatering dredged material by vacuum filtration was investigated. Samples from six disposal areas were characterized: Penns Neck Spillway, Apalachicola Bay, Mobile Bay, Toledo Harbor, Craney Island, and Browns Lake. Particle size distributions, specific resistance to filtration, filter leaf studies, and bench-scale vacuum filtration studies were conducted. Seven chemical coagulants were investigated with each sample. Dredged material was effectively dewatered to 45 to 60% solids (depending on site) using lime dosages of 7 to 10% of the solids in the sample. Filter yields of up to 9.0 lb solids/sq ft/hr were observed. Generally, the quality of the filtrate was in the range of 500 to 1500 mg/liter suspended solids. Pilot plant studies are recommended to further evaluate the operating parameters of vacuum filtration. (Small-FIRL)
W79-06332

DEMILITARIZATION OF CS I. CHEMICAL DISPOSAL OF CS BY HYDROLYSIS,
Edgewood Arsenal, Aberdeen Proving Ground, MD.
M. E. Brooks, P. M. Davis, and S. Sass.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A033 469, Price codes: A02 in paper copy, A01 in microfiche. Technical Report, 1976. 19 p, 3 tab, 4 ref.

Descriptors: *Ultimate disposal, *Water pollution sources, *Hydrolysis, *Chemical warfare, Waste treatment.

Studies of the chemical disposal of CS (tear gas or orthochlorobenzamalonitrile) by conversion to a salable product, were performed. Alkaline hydrolysis of CS was selected as the simplest means of converting CS to a salable product, O-chlorobenzaldehyde. Initially isopropyl alcohol was used as a solvent, but when that failed to yield the desired salable end product, a slurry of 16.6 w/v% CS in 6.6% aqueous NaOH (2 moles of NaOH per mole of CS) was used. The O-chlorobenzaldahyde can be recovered from the water phase by extraction with benzene or methylene chloride. For plant scale demilitarization of CS, the following parameters are recommended: NaOH:CS ratio = 1.1:1, NaOH concentration = 6% or 12%, reaction temperature is 35 to 50C, reaction time = 10 min, product separation occurs as a second liquid phase, and product purification is by water wash at ambient temperatures. (Small-FIRL)
W79-06336

LAND TREATMENT OF WASTEWATER AT WEST DOVER, VERMONT,
Army Terrestrial Sciences Center, Hanover, NH.
J. R. Bouzoun.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A046 300, Price codes: A03 in paper copy, A01 in microfiche. Special Report 77-33 October 1977. 31 p, 7 fig, 9 tab, 12 ref, 5 append.

Descriptors: *Spray irrigation, *Return flow, *Sewage treatment, *Flow rates, *Seasonal, Cold regions, Infiltration, Runoff, Monitoring, Test wells, Waste water treatment, Waste water disposal, Municipal wastes, Treatment facilities, Spraying.

Secondary effluent has been sprayed on a forested knoll in West Dover, Vermont, for two years as part of the land application waste water treatment operation. The rate of application was designed for a winter flow of 0.55 mgd; winter volumes are higher than other seasons due to an influx of winter vacationers. The spraying of effluent has been conducted at ambient temperatures down to 10F. Freezing problems in the spray nozzles and laterals have been corrected; all upward spraying nozzles are spaced 50 ft apart in summer and 25 ft apart in winter. Summer-Fall design flow rates average 0.30 mgd while Spring design flow rate average 0.11 mgd. Effluent samples, groundwater wells, diversion ditch flows, and nearby streams are being monitored to evaluate the treatment process. Further investigations are examining the possibility of producing snow from the secondary effluent to insulate the soil against freezing and thus insure infiltration of the water into the soil throughout the winter and reduce runoff during spring melt. (Lisk-FIRL)
W79-06341

UTILIZATION OF SEWAGE SLUDGE FOR TERRAIN STABILIZATION IN COLD REGIONS,
Army Terrestrial Sciences Center, Hanover, NH.
For primary bibliographic entry see Field 8D.
W79-06342

SOLID WASTE DISPOSAL BY LANDSPREADING TECHNIQUES,
Civil Engineering Lab. (Navy), Port Hueneme, CA.
E. R. Durlak.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-B017 149, Price codes: A04 in paper copy, A01 in microfiche. Technical Note N-1471, 1977. 74 p, 31 fig, 14 tab, 29 ref, 3 append.

Descriptors: *Solid waste, *Ultimate disposal, Sludge disposal, *Application methods, *Aerobic treatment, Vegetation, *Soil disposal fields, Soils, Waste treatment, Waste disposal.

The landspreading technique for solid waste disposal is described and discussed. Landspreading is the disposal of solid waste by mixing compostable materials into the topsoil so that the decomposition process remains aerobic. Landspreading advantages include minimum settling of the land, no undesirable odors or leachates, a potential for the support of vegetation, continued usefulness of the land, restoration in a minimum amount of time, and improvement in soil texture and water retention. Three types of construction rototillers and two types of soil were examined in a study of the homogenization of solid waste into the top soil to depths up to 20 inches. Rototillers adequately mixed 10 to 12 inches of soil with solid waste piled about 12 inches deep on the ground. The mixture in the test plots was both homogeneous and uniform to about 16 inches. Some plant growth resulted. (Small-FIRL)
W79-06343

PHOTOGRAPHIC WASTE UTILIZATION,
Horizons, Inc., Cleveland, OH.
S. S. Donovan.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A033 065, Price codes: A02 in paper copy, A01 in microfiche. Technical Report AFAL-TR-76-162. 1976. 51 p, 14 fig, 23 tab, 26 ref.

Descriptors: *Waste water disposal, *Landfills, Sanitary engineering, *Photography, *Recycling, Ultimate disposal, Pollution abatement, *Chemical wastes.

The pollution hazards associated with the disposal of 10 tons/wk of photographic processing wastes were eliminated by incorporating photowaste into a ceramic foam, a ceramic castable, and to modify it to an untramarine pigment. The ceramic foam could be used as an insulating firebrick and the ceramic castable could be used as an insulating castable. Each green product contained 10 wt% of photowaste, and physical properties of the producta were identical or better than comparable commercial products. The foam cost about 23.6 cents/lb and the castable 25.5 cents/lb, to manufacture. Necessary capital equipment and a functional plant layout, are given. A portable unit for on-site foam fabrication under a wide range of climatic conditions is also described. All three approaches were technically feasible, but pigment fabrication was economically unfeasible. Tests were also conducted to render the waste harmless and suitable for a class three landfill. Clay-containing foam cured at 1000F or non-clay-containing foam cured at room temperature were suitable for landfills that were not excessively alkaline. Castable cured at 1000F was suitable for alkaline landfills. (Small-FIRL)
W79-06371

LANDFILL DISPOSAL OF HAZARDOUS WASTES; A REVIEW OF LITERATURE AND KNOWN APPROACHES,
Environmental Protection Agency, Washington, DC. Office of Solid Waste.
T. Fields, and A. W. Lindsey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-261 079, Price codes: A03 in paper copy, A01 in microfiche. Report EPA/530/SW-165, 1975. 36 p, 1 fig, 4 tab, 32 ref, 1 append.

Descriptors: *Landfills, *Ultimate disposal, Injection wells, *Chemical wastes, Groundwater, *Hazards, Radioactivity, *Solid wastes, Incineration.

A review is presented of conventional sanitary landfilling, the chemical waste landfill, and alternatives to chemical waste landfill disposal. Research, development, and demonstration programs in hazardous waste land disposal are discussed. Hazardous wastes are categorized as toxic chemical, radioactive, flammable, explosive, or biological. Existing industrial waste landfills are described. Site design and preparation are considered including liners, pH adjustments, cover materials, and observation/monitoring wells. Various waste preparation methods are described including chemical fixation, volume reduction, waste segregation, detoxification, degradation, and encapsulation. Alternatives to chemical waste landfills such as incineration, deep well injection, ocean dumping, and detonation. (Small-FIRL)
W79-06374

LAND APPLICATION OF WASTE MATERIALS FROM DREDGING, CONSTRUCTION, AND DEMOLITION PROCESSES,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
C. R. Lee, R. M. Engler, and J. L. Mahloch.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A026 842, Price codes: A03 in paper copy, A01 in microfiche. Final Report, 1976. 43 p, 9 fig, 6 tab, 42 ref.

Descriptors: *Construction, *Dredging, Landfills, Waste disposal, *Ultimate disposal, Environmental engineering, *Costs, Recreation facilities, *Environmental effects.

Land application of wastes generated by dredging and by construction and demolition is discussed. The physical and chemical characteristics of the waste materials are described. Potential uses for these materials are discussed including agricultural production, land improvement, wildlife habitat development, recreational facilities, and industrial and residential landfill. Environmental impacts and social and psychological concerns are considered. Information on which dredged material and land application sites are compatible coupled with sound scientific management should achieve productive uses of dredged material that are economically feasible and environmentally sound. (Small-FIRL)
W79-06377

MULTIMEDIUM MANAGEMENT OF MUNICIPAL SLUDGE.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-274 093, Price codes: A10 in paper copy, A01 in microfiche. Report 1977. 202 p, 7 fig, 23 tab, 187 ref, 1 append.

Descriptors: *Ultimate disposal, *Sludge disposal, *Municipal wastes, *Decision making, *Environmental effects, Waste water treatment, Metals, Toxicity, Costs, Performance.

Methods available for managing municipal waste water treatment residuals are reviewed. The disposal or reuse of sludge in three environmental media is considered: ocean, land, atmosphere. Sludge management options are compared in terms of their primary impacts, intermedium effects, risk of environmental damage, technical reliability, direct and indirect costs, and status in regard to present environmental regulation. These comparisons are used to outline a general approach to decision making in sludge management. The final stages of the waste water treatment system are emphasized, but the study also examines the potential for lowering the concentration of metals and other toxic materials in sludge through source control and pretreatment of industrial wastes. (Small-FIRL)
W79-06379

5F. Water Treatment and Quality Alteration

NITRATE ANALYZER MONITORS AILING WELL,
Garden City Park Water District, NY.
For primary bibliographic entry see Field 5A.

W79-06007

CHOOSING A POTABLE WATER SUPPLY: WHAT YOU NEED TO KNOW,
New Jersey Inst. of Tech., Newark.
For primary bibliographic entry see Field 6B.
W79-06008

WATER TREATMENT: TASTE AND ODOR.
Ground Water Age, Vol 12, No 11, p 25, 26, 30, July, 1978.

Descriptors: *Water treatment, *Taste, *Odor, *Turbidity, *Palatability, Aesthetics, Organic matter, Dissolved gases, Dissolved minerals, Activated carbon, Filtration, Chlorination, Potable water.

Factors affecting palatability in drinking water include taste, odor and turbidity. Organic matter is the chief cause of bad taste and odor in water. Sources of organic matter are algae, industrial wastes, and decaying organic matter. They can be treated by filtration through a bed of activated charcoal or by hypochlorination. Dissolved gases are another major source of bad taste and odor in water. The most common gas, hydrogen sulfide, imparts a rotten egg smell to water and causes it to be highly corrosive. Hydrogen sulfide can be removed with either an activated charcoal filter or an oxidizing filter. Dissolved minerals cause a bad taste but do not affect odor. Iron and manganese create a sharp metallic taste and stain clothing, plumbing fixtures and food. Highly alkaline water may have a soda taste. Various neutralizing methods are available to lower the pH. Excess sulfate content is common in water in some areas of the country. A demineralizing filter should be used for drinking water with this problem. Turbidity is caused by small insoluble particles suspended in the water. Although they may be harmless, odorless and tasteless, they still are unsightly. Turbidity can be removed by mechanical filtration or coagulation. (Purdin-NWWA)
W79-06015

EVALUATION OF SORBENTS AS ORGANIC COMPOUND ACCUMULATORS,
Ames Lab., IA.
C. D. Chriswell, J. S. Fritz, and H. J. Svec.
Available from the National Technical Information Service, Springfield, VA 22161 as IS-M 123, Price codes: A04 in paper copy, A01 in microfiche. 1977. 9 p, 1 fig, 4 tab, 6 ref.

Descriptors: *Sorption, *Activated carbon, Water purification, *Resins, Organic matter, Properties, *Municipal water, Potable water, Water treatment.

Sorptive properties of fifteen activated carbons and synthetic resins were evaluated by comparing recovery of organic materials to results obtained with XAD-2 resin. The test sorbents included three polystyrene-divinylbenzene (PS-DV) macroreticular resins, two acrylic ester macroreticular resins, one phenol-formaldehyde absorbent, three week-base anion exchange resins, six activated carbons, and one carbonaceous resin. Four municipal water supplies were sampled using parallel sorption columns. The highest recoveries were obtained using the PS-DV macroreticular resins. Recoveries were lower from acrylic ester macroreticular resins than from PS-DV resins but were higher than from other sorbents. Recoveries from activated carbons were generally quite low. (Small-FIRL)
W79-06037

PROBLEM DEFINITION STUDY: PRODUCTION AND TESTING OF PYROGEN-FREE WATER UNDER FIELD CONDITIONS,
Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
J. J. Barkley, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A049 033, Price codes: A03 in paper copy, A01 in microfiche. Technical Report 7612, November 1976, 30 p. 86 ref, 2 append.

Descriptors: *Pyrogens, *Water purification, *Pharmacy, *Limulus Amebocyte Lysate test, *Public health, *Endotoxins, *Methodology, *Water treatment, Pyrogen-free water, Activated carbon, Potable water, Medicine, Bioassay, MUST Pharmacy Modules, Chlorination, Bacteria, Gram-negative bacteria, Costs, Testing procedures, Fever, Microorganisms, Algae, Toxicity, Poisons, Ultraviolet radiation, Ozone, Sterilization, Military aspects.

The best water treatment system for pyrogen removal from potable water for pharmaceutical applications and subsequent testing of purified water under field conditions (particularly military) consists of ion-exchange, carbon absorption, UV irradiation, and ozonation; the Limulus Amebocyte Lysate test (LAL) is the preferable testing method. Pyrogens, derived from certain metabolic by-products of bacteria, molds, some yeasts, viruses, and algae, and from certain chemicals, cause fever when injected into mammals, though not when ingested. Chemical pyrogens are removed by standard water treatment practices, but progens pass through most bacterial filters. Biological pyrogens are often referred to as endotoxins; the most potent are derived from gram-negative bacteria. Distillation, the most widely used method of pyrogen removal, is the most costly: production of 100 gal pyrogen-free water in 16 hrs requires 18.2 kw electricity and 0.9 gal cooling water/min., while the recommended system would consume less than 0.5 gal/min cold water and no more than 3 kw. The rabbit test is the only test recognized by the US Pharmacopeia (USP), but in field uses, such as in the Pharmacy Module of MUST-equipped hospitals, disadvantages include the need to maintain test animals, three-hr duration, and requirement of skilled personnel. The LAL test is commercially available, rapid, simple, and specific, though it is pH; temperature; and agitation-dependent. This test uses the blood cell (amebocyte) of the horseshoe crab (Limulus polyphemus). (Lynch-Wisconsin)
W79-06044

ENVIRONMENTAL ASSESSMENT GUIDANCE MUNICIPAL SEWAGE TREATMENT WORKS PROGRAM.
Environmental Protection Agency, Chicago, IL. Water Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 150, Price codes: A05 in paper copy, A01 in microfiche. Report No EPA-905/2-77-004, October 1977. 89 p, 4 fig, 5 append.

Descriptors: *Treatment facilities, *Sewage treatment, *Planning, *Evaluation, Social aspects, Economic evaluation, Environmental effects, Cost analysis, Waste water treatment, Waste disposal.

A working document of a general nature intended to assist in the preparation of facility plans for construction of municipal sewage treatment works is presented. Environmental, social, and economic evaluation are viewed as an integral part of the facilities-planning process and should be performed throughout the process. A cost-effective analysis is defined as a systematic comparison of alternative ways of dealing with waste water treatment and disposal problems to identify the solution which will minimize total costs to society; these costs are monetary and environmental. Guidelines are presented for an inventory of the existing environment, the development of alternatives, and evaluating the environmental impact. (Davison-IPA)
W79-06095

MONOGRAPH ON CARBON: ACTIVATED CHARCOAL,
Informatics, Inc., Rockville, MD.
R. W. Rogers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 129, Price codes: A03 in paper copy, A01 in microfiche. Report No. FDA/BF-78/90, October 18, 1977. 41 p, 3 fig, 10 tab, 141 ref. FDA 223-76-2001.

Descriptors: *Carbon, *Activated carbon, *Filtration, *Water purity, *Water purification, Absorption, Waste water treatment, Data collections, Physical properties, Water pollution treatment.

The available scientific literature from 1920 to 1977 on carbon (activated charcoal) is summarized. In addition to being used as an antidote to poison, activated charcoal has been used in sugar refining, brewing, and as a filter in the purification of many products such as gelatin, lard, oils, fats, sorghum syrup, fruit juices, and water for the soft drink industry. Chemical information, biological data, and the biochemical aspects of carbon are given. (Davison-IPA)
W79-06104

DEVELOPMENT AND TESTING OF BREADBOARD ELECTROCHEMICAL ORGANIC CONTENT ANALYZER,
Life Systems, Inc., Cleveland, OH.
R. J. Davenport, and R. A. Wynveen.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A045 557, Price codes: A04 in paper copy, A01 in microfiche. Annual Report 1977. 69 p, 33 fig, 7 tab, 7 ref.

Descriptors: *Analytical techniques, *Instrumentation, Electrolytes, *Electrodes, *Adsorption, *Solutes, Organic wastes, Performance, Monitoring, Ozone, Disinfection, Water treatment, Water purification.

The Breadboard Electrochemical Organic Content Analyzer was developed to be interfaced with the Water Processing Element Pilot Plant and its data acquisition system. The analyzer was designed to monitor organic solute concentrations based on adsorption of the solutes on an indicating electrode, and measurement of the resulting decrease in the electrodes interfacial capacitance. The analyzer was capable of longterm, continuous monitoring of the ozonated effluent. The addition of electrolyte to the sample was an effective means of eliminating measurement errors resulting from changes in the pH and conductivity in the sample. The electrolyte used demonstrated the ability to avoid interferences from 03, Cl(-), NO3(-), and SO4(-2). There was no interference from 02, and there were no temperature effects. (Small-FIRL)
W79-06145

PILOT PLANT STUDIES TO EFFECT CHRYSOTILE ASBESTOS FIBRE REDUCTION DURING POTABLE WATER TREATMENT,
Ontario Ministry of the Environment, Toronto.
R. B. Hunsinger, J. Lawrence, and K. J. Roberts.
Technical Report 67, 1977, 37 p, 1 fig, 3 tab, 12 ref, 3 append.

Descriptors: *Potable water, Water treatment, *Filtration, *Asbestos, *Pilot plants, Turbidity, Efficiency.

Pilot plant studies incorporating conventional potable water pre-treatment and filtration were performed to assess asbestoiform fiber removal. Problems were encountered in consistent fortification of the pilot plant feed water with sufficient asbestos to make measurement of removal possible. Optimized conventional treatment did significantly reduce asbestos levels. Unfortunately, given the current state-of-the-art in counting technology, treatment efficiency cannot be determined accurately. No direct relationship was established between fiber concentration and turbidity, although low fiber concentration was generally associated with low turbidity. (Small-FIRL)
W79-06158

ACTIVATED CARBON ADSORPTION OF TRACE ORGANIC COMPOUNDS,
Illinois Univ. at Urbana-Champaign. Dept. of Civil and Ceramic Engineering.
V. L. Snoeyink, J. J. McCreary, and C. J. Murin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 253, Price codes: A07 in paper copy, A01 in microfiche. Technical Report EPA-600/2-77-223, 1977. 115 p,

42 fig, 17 tab, 70 ref.

Descriptors: *Adsorption, *Activated carbon, *Organic matter, *Organic compounds, Isotherms, *Humus, *Odor, Potable water, Fluorescence, Water treatment, Humic acids.

Activated carbon adsorption of humic substances and trace contaminants 2-methylisoboreol (MIB), geosmin, the chlorophenols and polynuclear aromatic hydrocarbons (PAH) was investigated under competitive adsorption conditions encountered in natural waters. Isothermal tests and small-scale laboratory columns were used. Humic substances were obtained from a commercial source, well water, leaf extract and soil extract. Significant differences were observed in adsorption, haloform formation potential, and fluorescence. A method for the synthesis of MIB was developed along with a gas chromatographic analytical technique for MIB and geosmin (0.1 microgram/liter). These naturally occurring odorous compounds were more strongly absorbed than humic substances which compete with MIB and geosmin for adsorption sites. Chlorophenols and PAH's were strongly adsorbed. Anionic and neutral species of 2,4-dichlorophenol and 2,4,-6-trichlorophenol competed for adsorption sites even at a concentration of 1 microgram/liter. Except at a pH of 7.0, the observed data conformed to the Langmuir model for competitive adsorption, or the Jain and Snoeyink modification of the Langmuir model. A significant reduction in chlorophenol adsorption capacity resulted with the presence of various humic substances. Also, humic acid did not interfere with the rate of adsorption of anthracene, a model polynuclear aromatic hydrocarbon. (Small-Firl)
W79-06330

UTILITY DISTRIBUTION SYSTEMS IN ICELAND,
Army Terrestrial Sciences Center, Hanover, NH.
For primary bibliographic entry see Field 8A.
W79-06337

INACTIVATION OF VIRUSES IN WATER BY BROMINE AND ITS COMPOUNDS: INFLUENCE OF VIRION AGGREGATION,
North Carolina Univ. at Chapel Hill. School of Medicine.
D. G. Sharpe, and J. D. Johnson.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A048 622, Price codes: A06 in paper copy, A01 in microfiche. Final Report, 1977, 103 p, 51 fig, 40 ref.

Descriptors: *Viruses, Diseases, *Bromine, *Disinfection, Water purification, Electron microscopy, *Hydrogen ion concentration, *Aggregates, Particle size.

The inactivation of poliovirus and reovirus by bromine in water was investigated. OBr(-) reacted most rapidly with dispersed poliovirus reducing plaque-forming infectivity about 3 log(10) units/sec at a concentration of 9.6 at 2C and pH 11. The rate of inactivation with Br2 at pH 5 was 0.8 log (10) units/sec. Corresponding rates with HOBr, NBr3, and NHBr2 were 0.12, 0.035, and 0.004 log(10) units/sec at pH 7. Reovirus was more sensitive to HOBr than polio virus, but when aggregation was present, reovirus survived bromine treatment that destroyed well dispersed poliovirus. Aggregated preparations of both viruses reacted with HOBr with a continuously decreasing reaction rate. The most resistant units were the larger aggregates. Electron microscopy demonstrated that virus particles are generally aggregated in the crude or unpurified state. Experimental techniques to determine aggregation were developed, and the fate of aggregates in different types of water and at different pH levels, was investigated. (Small-Firl)
W79-06338

DECONTAMINATION OF WATER CONTAINING CHEMICAL AND RADIOLOGICAL WARFARE AGENTS BY REVERSE OSMOSIS,
Army Mobility Equipment Research and Development Command, Fort Belvoir, Va. Energy and Water Resources Lab.
For primary bibliographic entry see Field 5D.
W79-06340

CRITERIA FOR THE PRODUCTION OF HIGH PURITY WATER,
Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
J. J. McCarthy.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A049 032, Price codes: A04 in paper copy, A01 in microfiche. Technical Report 7714, 1977. 63 p, 18 tab, 67 ref.

Descriptors: *Specifications, Water quality, *Water purification, *Laboratories, *Hospitals, Ion exchange, Reverse osmosis, Distillation, Filtration, Adsorption, *Water pollution.

Information is presented which should be considered during the design or specification of high purity water production systems in health care facilities and laboratories. Water quality is discussed, and summaries of commonly used water quality criteria are presented. Design considerations are discussed for ion exchange, reverse osmosis, distillation, filtration, and carbon adsorption techniques. Design considerations for the distribution and storage of high purity water are discussed including construction materials and centralized versus decentralized systems. Water quality should be monitored periodically to ensure suitability for use and to make possible the detection of contaminants developed during production, storage, and distribution. (Small-FIRL)
W79-06354

ALTERNATIVES TO CHLORINATION FOR CONTROL OF CONDENSER TUBE BIO-FOULING,
Monsanto Research Corp., Dayton, OH.
H. H. S. Yu, G. A. Richardson, and W. H. Hedley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 269, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-600/7-77-030. March 1977. 74 p, 14 fig, 9 tab, 28 ref.

Descriptors: *Cooling water, *Fouling, *Powerplants, *Chlorination, *Water treatment, Bromie, Ozone, Iodine, Radiation, Cleaning, Condensers.

Better techniques of chlorination or alternatives to chlorination of power plant effluent for preventing bio-fouling in cooling systems, especially condenser tubes, were evaluated. The assessments were directed toward reducing free-chlorine residuals in effluent released into receiving waters where chlorinated compounds may have toxic effects on aquatic microorganisms or may enter drinking water supplies. Parameters evaluated and compared in the study included: technical feasibility; environmental effects; engineering problems; relative capital, operational, and chemical costs; actual dollar costs; and present state of technology. Chemical applications evaluated for treating fresh or marine cooling water in once-through or closed cycle systems included: chlorine, bromine, chloride, iodine, ozone, chlorine dioxide, hypochlorite, and controlled-release pesticides. On-line mechanical cleaning of condenser tubes in cooling systems were also considered; these included the utilization of sponge rubber balls, bruch devices, or hot water backflushing. Ultraviolet and gamma radiation were evaluated as physical-chemical treatments. Improved procedures of chlorination as alternatives to continuous chlorination included: dosing at the inlet of condensers, serially; dechlorination; chlorination by feedback control of residuals; and blowdown timing control. (Lisk-FIRL)
W79-06358

OIL/WATER SEPARATION STATE-OF-THE-ART,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Chemical and Biochemical Engineering.
F. A. Osamor, and R. C. Ahlert.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 755, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-78-069, 1978. 104 p, 10 fig, 4 tab, 176 ref.

Descriptors: Oil industry, *Evaluation, *Oil pollution, Oil wastes, Oily water, Oil-water interfaces, *Separation techniques, Water quality control, *Testing, Ships.

The state-of-the-art of oil and water separation devices and processes was investigated. The technology available for shipboard and shoreside treatment of bilge and ballast waters and the oily waste water associated with crude oil production was considered. Separation devices were classified according to the primary mechanisms that induce separation of oil/water mixtures. The basic concepts of each class of equipment, design features, operational conditions, and device limitations are discussed. Literature on test evaluation of devices was critiqued on the basis of actual or potential success in treating various oil/water systems. No single technique can separate all oil/water system states efficiently. (Small-FIRL)
W79-06360

A THEORY ON WATER FILTRATION, PART I: BACKGROUND,
Civil and Environmental Engineering Development Office, Tyndall AFB, FL.
S. P. Shelton.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A045 387, Price codes: A03 in paper copy, A01 in microfiche. Report CEED0-TR-77-1, 1977. 34 p, 2 fig, 1 tab, 49 ref, 1 append.

Descriptors: *Filtration, Aerosols, *Efficiency, Water treatment, *Mathematical models, Flow, Suspended solids.

Background is given for a project which applied existing theoretical concepts used in aerosol mechanics to various water filtration systems. Equations were developed to describe the water filtration processes as a function of the characteristics of the fluid, suspended particles, and filter media. Information is presented on small particle collection, air filtration efficiency, and the effects of flow, pressure, and time. (See W79-06388 and W79-06389) (Small-FIRL)
W79-06387

A THEORY ON WATER FILTRATION PART II. MODEL PRESENTATION,
Civil and Environmental Engineering Development Office, Tyndall, AFB, FL.
S. P. Shelton.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A045 607, Price codes: A02 in paper copy, A01 in microfiche. Report CEEDO-TR-77-2, 1977. 18 p, 1 fig, 24 ref.

Descriptors: *Filtration, Aerosols, Water treatment, *Efficiency, Sands, *Mechanical properties, *Suspended solids, Mathematical models.

Existing theoretical concepts used in aerosol mechanics were applied to various water filtration systems. These equations were then used to described water filtration processes as a function of the characteristics of the fluid, suspended particles, and filter media. The model integrates numerically to determine the pressure drop caused by the sand, the suspended particles collected in the sand, and the filter efficiency for both the sand and the suspended particles (the cake) at different time increments. Also, it computes the average efficiency from the start to any point in the filter cake. The sand bed and filter cake characteristics are then modified for each increment to reflect the net change in their characteristics caused by particles collected during the previous integration increment. (See also W79-06387) (Small-FIRL)
W79-06388

A THEORY ON WATER FILTRATION, PART III - SENSITIVITY ANALYSIS, DATA EVALUATION AND CONCLUSIONS,

Civil and Environmental Engineering Development Office, Tyndall Air Force Base, FL.
S. P. Shelton.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A043 290, Price codes: A03 in paper copy, A01 in microfiche. Report CEEDO-TR-77-3, 1977. 37 p, 5 fig, 8 tab, 61 ref.

Descriptors: *Filtration, Aerosols, Water treatment, *Efficiency, Sands, Mechanical properties, *Suspended solids, *Mathematical models, Flow.

Existing theoretical concepts used in aerosol mechanics were applied to various water filtration systems. These equations were used to describe water filtration processes as a function of the characteristics of the fluid, suspended particles, and filter media. These models were examined from the standpoint of their interrelated parameters and their applicability to known filtration data. The sand filtration model demonstrated a potential to predict the relationship between flow, pressure, time, and efficiency. Data validation of the model indicated that its predictions were within the range of predictions made by classical water filtration models for typical data ranges. Also, the new model could predict filter efficiency for a wide range of fluid-particle suspensions and filter media. (See also W79-06387) (Small-FIRL)
W79-06389

THE POTENTIAL CONTRIBUTION OF DESALTING TO FUTURE WATER SUPPLY IN NEW MEXICO,
Southwest Research Inst., San Antonio, TX.
For primary bibliographic entry see Field 3A.
W79-06428

5G. Water Quality Control

EXPERIMENTS AIMED AT THE REMOVAL OF PHOSPHATE BY ELECTROCHEMICAL METHODS,
Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
For primary bibliographic entry see Field 5D.
W79-06033

EFFECT OF DRAINAGE SYSTEM DESIGN AND OPERATION ON NITRATE TRANSPORT,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
R. W. Skaggs, and J. W. Gilliam.
Paper No. 78-2501, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, IL. 13 p. 9 fig, 3 tab, 18 ref, ASAE, St. Joseph, Michigan.

Descriptors: *Nitrates, Simulation analysis, *Drainage effects, Drainage systems, Drainage water, Surface drainage, Subsurface drainage.

Simulations were conducted to predict NO3(-) movement from artificially drained soils. Effects of alternative drainage designs and operational procedures on NO3(-) outflow to drainage waters were presented. (Skogerboe-Colorado State)
W79-06036

GROUND-WATER CONTAMINATION BY FERTILIZER NITROGEN,
Science and Education Administration, Fort Collins, CO.
H. R. Duke, D. E. Smika, and D. F. Heermann.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineering, Vol 104, No 1R3, p 283-291, September, 1978. 6 fig, 2 tab, 8 ref.

Descriptors: *Irrigation programs, *Water pollution, *Leaching, *Nitrates, Fertilizers, Denitrification, Water management, Groundwater.

A partial analysis is presented of the results of studies on the effects of irrigation practices on the movement of water and nitrate toward the water table. The study area was an alluvial valley of the South Platte River near Crook, Colorado. Four sandy plots, irrigated with center pivot sprinkle systems, were instrumented to measure directly all components of the water budget during the growing season. Vacuum extractors were installed beneath each plot to measure deep percolation. Water samples for NO3-N analysis were collected periodically from each extractor, from irrigation and stock wells, and from piezometers. Soil samples were also collected. Three of the plots were irrigated according to the USDA irrigation scheduling program. A fourth plot was irrigated nearly continuosly which resulted in leaching of significant amounts of NO3-N beyond the root zone. A high concentration of 50 ppm was found near the water table but decreased rapidly with depth. This may be due to the denitrification effect of microbial activity or ferrous iron in the anaerobic region of the aquifer. If significant denitrification occurs, the potential for groundwater pollution by leached nitrates is considerably reduced. However, careful water management remains an important factor in the irrigation program. (Purdin-NWWA)
W79-06081

THE INTEGRITY OF WATER,
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 238, Price codes: A10 in paper copy, A01 in microfiche. Proceedings of a Symposium, March 10-12, Washington, DC, 223 p, 84 fig, 10 tab, 153 ref. Environmental Protection Agency, Washington, DC.

Descriptors: *Water quality, *Federal Water Pollution Control Act Amendments of 1972, Environmental effects, Human population, Groundwater, Surface waters, Physical properties, Chemical properties, Biological properties.

The twenty-two papers presented at an invitational symposium focus on the definition and interpretation of water quality integrity as viewed and discussed by representatives of State governments, industries, the academic community, conservation and environmental groups and the general public. The quantitative and qualitative characteristics of the physical, chemical, and biological properties of surface and groundwater were addressed. (Davison-IPA)
W79-06103

GREAT LAKES RESEARCH ADVISORY BOARD ANNUAL REPORT TO THE INTERNATIONAL JOINT COMMISSION,
1978. 64 p, 1 fig, 2 tab, 30 ref.

Descriptors: Great Lakes region, *Great Lakes, *Toxins, Water pollution, *Phosphorus, Water quality standards, *Ecosystems, *Data storage and retrieval, Dredging, Solid wastes, Water quality.

The past activities of the principal scientific advisor to the Commission on Great Lakes water quality (US-Canada) are discussed as they relate to three concerns: toxic substances, water quality and the Great Lakes ecosystem, and phosphorus limitations. Governments are requested to coordinate efforts to identify existing data bases and develop new data bases with information on physical, chemical, and toxicological data. An immediate joint effort to review and assess alternative dredged material disposal policies is recommended. Also, a recognized policy is needed for an ecosystem approach to water quality management. Further, studies are recommended to determine the most cost-effective programs for reducing phosphorus loadings. (Small-Firl)
W79-06125

GREAT LAKES WATER QUALITY SIXTH ANNUAL REPORT TO THE INTERNATIONAL JOINT COMMISSION,
1978. 89 p, 6 fig, 20 tab.

Descriptors: *Great Lakes region, *Legislation, *Water quality, Regulation, Priorities, Toxicity, *Chemical wastes, Public health, Environmental effects, Governments.

Progress by the Great Lakes Water Quality Board toward compliance with the original 1972 Water Quality Agreement is discussed. Recent water quality, remedial programs, legislation, and water quality board activities are described. A review is presented of previous assessments and recommendations of the Water Quality Board, and water quality objectives. Due to the presence of low concentrations of toxic chemicals, the board recommends that governments develop rational schemes to order priorities for evaluating the risk of toxic chemicals to human health and environment. It is also recommended that governments initiate programs to control the production, use, and disposal of chemicals that are potentially toxic. (Small-FIRL)
W79-06129

CRITERIA OF WATER QUALITY IN RELATIONSHIP WITH THE FINAL USE OF THE RECEIVING BODY AND ITS ASSIMILATION CAPACITY (CRITERIOS DE CALIDAD DEL AGUA EN RELACION CON EL USO FINAL DEL CUERP RECEPTOR Y SU CAPACIDAD DE ASIMILACION),
Esso S.A.P.A., Argentina.
A. H. Torrea, E. Alvarez, N. E. Catarineu, and L. Peisojovich.
ATIPCA (Asociacion de Tecnicos de la Industria Papelera y Celulosica Argentina), Vol. 17, No. 2, p 2, 6-10, 12, 16-18, 20-21, 1978. 20 ref.

Descriptors: *Water quality, *Waste assimilative capacity, *Surface waters, Water quality control, South America, Argentina.

The application of water quality criteria based on the final use of the receiving water body and its assimilation capacity permits establishing levels of quality resulting in reduced effluent treatment requirements. Concepts are developed on the determination of the final use of a receiving body. Methodology is analyzed for establishing the assimilation capacity of the receiving body through various formulae. Taking these aspects into account, methods are suggested for evaluating the cost-benefit relationship in making a decision with the object of utilizing to the maximum the particular conditions of a receiving water body. A regional system for water quality control in Argentina is proposed. (Speckhard-IPC)
W79-06143

EFFICIENT AMENDMENT USE IN SODIC SOIL RECLAMATION,
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Inst. of Soil and Water.
R. J. Prather, J. O. Goertzen, J. D. Rhoades, and H. Frenkel.
Soil Science Society of America Journal, Vol 42, No 5, p 782-786, September-October, 1978. 8 fig, 5 tab, 9 ref.

Descriptors: *Reclamation, Alkali soils, *Soil amendments, Calcium sulfate, Gypsum, Calcium chloride, Sodium, *Leaching, Regression analysis.

A laboratory column study of sodic soil reclamation was carried out using two soils high in exchangeable sodium percentage (ESP) and cation exchange capacity (CEC). Three amendments ($CaSO_4.2H_2O$, $CaCl_2.2H_2O$, and H_2SO_4) were used singly and in combination to test their effectiveness and efficiencies with respect to amount of amendment, time, and leaching needed. As a single amendment, H_2SO_4 was more effective than $CaSO_4$ and results in a more desirable ESP profile than $CaCl_2$. Combining either $CaCl_2$ or H_2SO_4 with $CaSO_4$ (proportions of 1/4 and 3/4, respectively) appreciably reduced the time and leaching needed to achieve reclamation as compared with $CaSO_4$ alone. It was observed that certain soil conditions preclude or make undesirable the use of $CaSO_4$ alone and combining amendments results in effective reclamation and a potential savings in amendment costs. (Skogerboe-Colorado State)
W79-06150

DETERMINING WATER QUALITY CRITERIA FOR WATER FLOW IN SOLVING THE PROBLEMS OF CONTROLLING WATER POLLUTION,
Kh. A. Velner, V. I. Gurariy, and A. S. Shayn.
In: American-Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Kharkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 193-205 (Discussion p 206-207), September 1978. 1 fig, 3 tab, 14 ref. EPA-600/9-78-024.

Descriptors: *Water pollution control, *Flow, *Water quality criteria, *Soviet Union, Effects, Assessment, Equations, Questionnaires, Decision making, Water bodies, Classification, Statistical methods.

In the Soviet Union, water quality improvement is considered one of the most important economic and political problems at the present stage of social development. Needed are methods for the objective assessment of water quality. First, water quality must be defined quantitatively; developing a state system of quality control includes problems of planning, forecasting and optimization. Information based only on water quality evaluation by individual properties does not provide an adequate problem solution. Laws in the USSR set maximum permissible concentrations for harmful substances in impoundments and water courses and define the water quality in a reservoir for drinking water, recreation, and fish breeding. However, some deficiencies have been found in the existing criteria for water quality assessment from the design and maintenance of water installations. The decision-making procedure is not purely mathematical in character, having certain psychological attributes. VNIIVO's mathematical modeling lab distributed a questionnaire among experts, selecting the most significant parameters and evaluating them on a five-point system. The mean statistical value for each parameter, the frequency of possible maximum estimates, sum of ranks, and also probability characteristics, variance coefficient, concordance coefficient, and the statistical significance of the level of agreement among the experts were determined. Needed is a common system of water quality indexing. The application of analytical-expert methods allows establishment of a common approach to the problem of developing water quality criteria for water management systems. (See also W79-06166) (Bell Graf-Cornell)
W79-06174

EFFECTS OF CHANNEL DAMS ON DISSOLVED OXYGEN CONCENTRATIONS IN NORTHERN ILLINOIS STREAMS,
Illinois State Water Survey, Urbana.
T. A. Butts, and R. L. Evans.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 924, Price codes: A08 in paper copy, A01 in microfiche. Circular 132, 1978. 153 p, 6 fig, 6 tab, 14 ref, 1 append.

Descriptors: *Reaeration, *Streams, *Illinois, *On-site investigations, Dissolved oxygen, Water quality, Dams, Aeration, Data collections, Overflow, Spillways, Analytical techniques, Methodology.

This study was performed for the Northeastern Illinois Planning Commission (NIPC) to provide data for input into a comprehensive water quality model being developed for NIPC in conjunction with their Areawide Waste Treatment Management Study. The principal objective of this study was to gather physical data concerning the aeration characteristics of the dams for use in calibrating weir formulas developed in Great Britain. This entailed measuring upstream and downstream DOs and temperatures for extended time periods and determining the physical measurements and characteristics of the dams. In all, 53 different structures exist at 48 locations on study area streams. At 5 of those locations, 2 different spillway or release structures exist side by side. Forty of the 53 structures were sampled at 15-minute intervals for at least 4-hour segments. Detailed results observed and recorded in the field were presented in the appendix. Two photographs were shown for some structures to illustrate structural details more clearly or to show different flow conditions. It was concluded that most channel dams and weirs studied significantly affect water quality in almost all major study area streams. These effects should be incorporated into any mathematical model dealing with dissolved oxygen. This report was prepared for use as a preliminary guide. (Humphreys-ISWS)
W79-06234

FEDS PUSH FOR WHOLLY INTEGRATED STATE/EPA PROGRAMS,
C. W. Heckroth.
Water and Wastes Engineering, Vol. 15, No. 12, p 22-27, 30, December, 1978.

Descriptors: *Water pollution control federation, *Water quality control, *Integrated control measures, *Conferences, Toxins, Sludge disposal, Industrial wastes, Water reuse, Research priorities, Consolidation, Permits, Grants.

At the annual Water Pollution Control Federation meeting many topics were discussed. Among them were state-federal Environmental Protection Agency (EPA) agreements, pretreatment standards, toxic pollutants, national municipal policy and strategy, '208' programs, future legislation, Congress-EPA conflicts, water reuse, managing grants and permits, and a national research program. Speakers' conclusions are provided. One speaker said the EPA intends to consolidate its efforts by requiring each EPA region to enter into an annual agreement with its respective states covering all water and solid waste programs. Pretreatment standards for industrial plans are detailed herein. Control of toxic pollutants will be receiving more emphasis in the future and should constitute a major factor in formulating a national research program. Water reuse is being given top priority. Some ways in which EPA is encouraging water conservation are discussed. There is also a need to coordinate management of federal construction grants to municipalities, to insure compliance with the terms and stipulations of a community's National Pollutant Discharge Elimination System permit. The funding strategy for section 208 of the Clean Water Act is discussed. The '208' program gives state and area-wide agencies funds for implementing water quality management plans. (Horwich-Florida)
W79-06297

OLD WOMAN CREEK, OHIO: THE DESIGNATION OF A FRESHWATER ESTUARINE SANCTUARY,
Ohio Dept. of Natural Resources, Columbus.
For primary bibliographic entry see Field 6E.
W79-06301

SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES--LOWER MISSISSIPPI REGION,
Geological Survey, Little Rock, AR. Water Resources Div. and Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W79-06308

PERFORMANCE TESTING OF OIL MOP ZERO RELATIVE VELOCITY OIL SKIMMER,
Mason and Hanger-Silas Mason Co., Inc., Leonardo, NJ.
M. K. Breslin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 232, Price codes: A03 in paper copy, A01 in microfiche. Report EPA-600/7-78-060, 1978. 20 p, 7 fig, 2 tab, 2 append.

Descriptors: *Skimming, *Oil spills, Water pollution control, Oily water, *Prototypes, *Testing, *Separation techniques, Adsorption, Performance, Running waters, Mechanical equipment.

A fast current prototype skimmer designed and built by OMI with an operating range up to 3 m/sec, was tested. Oil was adsorbed onto oleophilic fibers woven into a rope. The rope and fibers were then squeezed by wringers to remove the oil. The device was operated in a controlled oil slick and monitored for oil recovery. Controlled independent variables included operating speed, oil slick thickness, tow speed, and wave conditions. Fluid recovery was sampled during and after the test run to determine skimmer performance. Results were evaluated in terms of recovery rate, recovery efficiency, and throughput efficiency. Only eight oil-collection test runs were made over two days because of adverse weather and problems with the device. Thus, parameters could not be completely optimized. (Small-FIRL)
W79-06359

PERFORMANCE TESTING OF THREE OFF-SHORE SKIMMING DEVICES,
Mason and Hanger-Silas Mason Co., Inc., Leonardo, NJ.
H. W. Lichte, and M. K. Breslin.
Report EPA-600/7-78-082. 1978. 77 p, 24 fig, 30 tab, 3 append.

Descriptors: *Oil spills, Oil pollution, *Testing, *Skimming, Mechanical equipment, *Performance, Evaluation, Waves(Water), Weather, Oceans.

Three off-shore skimming devices were evaluated as part of the assessment and evaluation of technology and procedures for controlling and cleaning up oil spills in the marine environment. Throughput efficiency, recovery efficiency, and oil recovery rate, were determined for the Cyclonet 100, MARCO class V Oil Skimmer, and the U.S. Coast Guard Skimming Barrier (CGSB). Test variables included several wave conditions and tow speeds to simulate harbor and offshore environments. Performance was maximum at speeds through the water of 1.5 m/sec or less, even in calm water. As wave conditions become more severe, performance deteriorates. Even relatively low breaking waves render the pickup devices effectively useless. Performance was better using the heavier of the two oils tested. Thus, effective use of the equipment depends on extremely favorable weather conditions. Further research and development are needed to establish effective cleanup methods which are effective in more severe sea conditions. (Small-FIRL)
W79-06365

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

ENVIRONMENTAL ASSESSMENT GUIDANCE MUNICIPAL SEWAGE TREATMENT WORKS PROGRAM.
Environmental Protection Agency, Chicago, IL. Water Div.
For primary bibliographic entry see Field 5F.
W79-06095

AMERICAN-SOVIET SYMPOSIUM ON USE OF MATHEMATICAL MODELS TO OPTIMIZE WATER QUALITY MANAGEMENT.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 696, Price codes: A20 in paper copy, A01 in microfiche. Proceedings: Kharkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Florida, September 1978. EPA 600/9-78-024, 453 p.

Descriptors: *Water quality, *Water pollution control, *Mathematical models, *River basins, *Simulation analysis, *Methodology, *United States, *USSR, Eutrophication, Ecosystems, Lakes, Management, Decision making, Forecasting, Water bodies, Systems analysis.

Group 6A—Techniques Of Planning

The American-Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management examines methodological questions related to simulation and optimization modeling of processes that determine water quality of river basins. Discussants describe the general state of development and application of mathematical models designed to predict and optimize water quality management in the USA and USSR. Subjects of papers presented by American and Soviet specialists include: planning comprehensive water quality protection systems; modeling water quality in river basins; geographic-economic aspects of pollution control systems; identification of ecosystem models by field data; management decisions for lake systems on a survey of trophic status, limiting nutrients, and nutrient loadings; a descriptive simulation model for forecasting the condition of a water system; mathematical ecosystem models and a description of the water quality in water bodies; mathematical modeling strategies applied to Saginaw Bay, Lake Huron, to eutrophical processes in Lake Ontario, to hydrodynamics and dispersion of contaminants in the nearshore, and to coastal currents in large lakes; and the construction of a model of Lake Baikal on the principles of self-organization. Publication of the proceedings held December 9-16, 1975, in Kharkov and Rostov-on-Don, USSR, is in compliance with the Memorandum from the Fourth Session of the Joint American-Soviet Committee on Cooperation in the Field of Environmental Research. (See W79-06167 thru W79-06184) (Bell-Graf--Cornell)
W79-06166

PLANNING COMPREHENSIVE WATER QUALITY PROTECTION SYSTEMS,
Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering.
D. P. Loucks.
In: American-Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Kharkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 1-33, September 1978. EPA-600/9-78-024. 3 fig, 15 ref.

Descriptors: *Comprehensive planning, *Water quality, *Protection, *Economic efficiency, *Optimization, *Simulation analysis, *Analytical techniques, *Model components, *USSR, *Cost minimization, Constraints, Mathematical models, Systems analysis, Mixed-integer programming, Linear programming, Nonlinear programming, River basins, Waste water(Pollution), Flow augmentation, Aeration, Land disposal.

This paper outlines several approaches to water protection modeling, emphasizing problem definition and model development. Reviewed is a number of mathematical modeling components which can be combined and solved for the preliminary planning of minimum cost, comprehensive water quality management programs for river systems. The techniques considered hopefully reflect an approach to long-run water quality protection planning that might be appropriate for various rivers in the USSR. The use of both optimization and simulation models permits the identification of those particular measures, their design specifications, and their operating policies, that will satisfy water quality, economic, and possibly other objectives. The optimization techniques herein have been developed for: wastewater treatment facilities; wastewater effluent storage lagoons; land disposal sites for wastewater disposal and additional treatment; flow augmentation reservoirs; and in-stream aeration devices. The models are static. Discussed are nonlinear, linear, separable, and mixed-integer programming, the last being recommended as the solution technique. The systems models and methods illustrated herein are not substitutes for judgment, but rather are aids to it in providing information and opportunities that otherwise might not be available. (See also W79-06166) (Bell-Graf--Cornell)
W79-06167

OPTIMIZATION OF WATER QUALITY CONTROL IN A RIVER BASIN,
A. K. Kuzin.
In: American Soviet Symposium on Use of Mathematical Model to Optimize Water Quality Management. Kharkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 36-52, September 1978. EPA-600/9-78-024. 2 fig, 12 ref.

Descriptors: *Water quality, *Protection, *River basins, *Optimization, *Methodology, *Mathematical models, *Decision making, Effluents, Treatment, Lagoons, Flow autmentation, Investment, Long-term planning, Analytical techniques, Systems analysis, Equations.

Water quality is considered in the development of a long-term optimum strategy determining capital investment policy in the USSR. The basin water protection programs, part of the nation's overall water protection program, are based on strategic objectives for 10 to 15 years. Weighty socio-economic prerequisites favor the basin approach to the control of water quality-effect factors. There are at least two ways of constructing an economic-mathematical model for optimization of anti-pollution measures on a drainage basin scale: construction of a united 'super-model' or a system of small mutually matched models. A number of serious shortcomings of a practical nature limit the use of 'super-models'. Optimization problems in the field of water protection are divided into three classes: Class 1 - problems of optimizing functionally different technical facilities; Class 2 - problems of interaction of differing facilities; and Class 3- problems of optimizing operationally different technical solutions. Investigation of relations among these has shown that during the optimization of water protection measures within the limits of a basin or basin section, a multilevel system of models can be developed, requiring a multilevel approach. Discussed are the stages in solving an optimization problem, and typical optimization problems for water protection measures are described. Widespread use of the decision-making optimization methodology outlined herein will yield high economic profits to the national economy. (See also W79-06166) (Bell-Graf--Cornell)
W79-06168

WATER QUALITY MANAGEMENT MODELS: SPECIFIC CASES AND SOME BROADER OBSERVATIONS,
Meta Systems Inc., Cambridge, MA.
R. J. DeLucia, and T. Chi.
In: American Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Kharkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 92-124, September 1978. EPA-600/9-78-024. 9 fig, 1 tab, 28 ref.

Descriptors: *Water quality, *Management, *River basins, *Planning, *Mathematical models, Optimization, Constraints, Pollutants, Treatment facilities, Costs, Biochemical oxygen demand, Dissolved oxygen, Constraints, Timing, Equations, Systems analysis, Capacity expansion, Cost minimization, Linear loss function, Convex separable programming, Size, St John River basin model, Descriptive modeling, Prescriptive model.

There is no one prescribed approach for model building for investment planning in water quality control. The development of a water quality model is dependent on the characteristics of the problem being examined. Considered herein are four areas of concern that influence model development: (1) the relationship of planning activity to the problems of variable specifications; (2) the nature of the institutional or client setting; (3) the type and quality of data available for model development; and (4) the availability of resources for model development and implementation. Discussed is the Saint John River basin model, whose development provides an example in which many important issues in these four areas arise; highlighted are the most significant issues. The notable features of the discussions which led to the development of the model in its present form are considered. Discussed in detail is the need to calibrate/verify the descriptive relationships in water quality modeling. It is concluded that there are two types of application or implementation problems associated with the use of water quality planning models: (1) acceptance of a descriptive or prescriptive model for use in an actual water quality planning study and (2) the implementation of a water quality plan that is based at least partially on a study in which a model has been used. It is recommended that a waste discharger be required to provide evidence to show his innocence in polluting, regarding any discharge believed to be harmful to the environment, instead of the present procedure which allows the polluter to be regarded innocent until proven guilty. An example of optimal capacity expansion of treatment facilities is given. (See also W79-06166) (Bell-Graf--Cornell)
W79-06170

MODELING AND DECISION-MAKING ASPECTS OF WATER QUALITY MANAGEMENT,
Environmental Protection Agency, Washington, DC. Water Planning Div.
M. A. Pisano.
In: American-Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Kharkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 180-190 (Discussion 191-192), September 1978. 2 fig, 3 tab. EPA-600/9-78-024.

Descriptors: *Water pollution control, *Decision making, *Mathematical models, *Water quality analysis, Planning, Evaluation, Dissolved oxygen, Evaluation, Rivers, United States, Methodology, Systems analysis.

This paper gives an overview of how approaches and concepts considered in several of the papers presented at this symposium may be utilized in the solution of complex water quality problems. These papers discuss key economic and political concepts that are used in the water quality management planning process of the United States. Also, the papers discuss some specific case study applications of these modeling approaches, as well as how some of the major planning concepts were employed in a particular area. Modeling, water quality analysis, and comprehensive planning approaches have played a very fundamental role in the implementation of our Federal Water Pollution Control Program. This paper describes that role and provides an assessment of modeling as it has contributed to our water quality management decisions. Considered is how the above approaches and concepts have been employed as a part of this role. (See also W79-06166) (Bell-Graf--Cornell)
W79-06173

IDENTIFICATION OF ECOSYSTEM MODELS BY FIELD DATA (INVERSE PROBLEMS OF ECOLOGY),
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
V. B. Georgiyevskiy.
In: American-Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Kharkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 263-279 (Discussion p 280-281), September 1978. 7 ref. EPA-600/9-78-024.

Descriptors: *Ecosystems, *Model studies, *Differential equations, *Field data, *Stochastic processes, *Model parameters, *Integral transformations, Algorithms, Dynamic model, Cartesian coordinates, Water biocenosis, Complete smoothing, Curvilinear orthogonal coordinates, Algebraic equations, Statistical models, Numerical analysis, Systems analysis, Plankton.

Proposed is the construction of ecosystem models to be identified herein on the basis of conventional

differential equations (dynamic models) and in partial derivatives. Identification is the determination of numerical values of coefficients for use in differential equations by first-hand observation of biotic and abiotic components of an ecosystem in a certain region. In ecology, problems of this kind are examined by identifying objects of automatic control. The usual identification method is to select numerical values for the model parameters which minimize the mean square difference between the observed and calculated trajectories. But ecological problems possess traits which hamper this approach. Given are the characteristics of inverse problems in ecology which necessitate identification without using solution of the direct boundary conditions. Proposed is the use of a method which does not use the solution of direct boundary equations; the method can be based on integral transformations of differential equations of ecological models aimed at excluding the experimental functions differential operation. Considered herein are: (1) type of differential equations of water ecosystem models; (2) model parameters as systemic characteristic of water biocenosis; (3) method of integral transformations; (4) minimum complexity integral transformation I for an equation with Cartesian coordinates; (5) integral transformations of complete smoothing for equation with Cartesian coordinates and for equations in general curvilinear orthogonal coordinates; (6) determination of variable and of dependent parameters; and (7) parameter determination with inadequate information available. (See also W79-06166) (Bell Graf-Cornell)
W79-06177

OPTIMAL DESIGN AND OPERATION OF MULTI-RESERVOIR SYSTEMS: VOLUME I: EXPLICITLY STOCHASTIC MODELS,
Johns Hopkins Univ., Baltimore, MD.
M. H. Houck, and J. L. Cohon.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-262 017, Price codes: A10 in paper copy, A01 in microfiche. Prepared for National Science Foundation, Washington, D.C., Report No SAE-PDM-76-01, June 1976. 187 p, 20 fig, 19 tab, 41 ref, append.

Descriptors: *Reservoir design, *Reservoir operation, *Model studies, *Optimization, *Linear programming, *Stochastic processes, *Decision making, Benefit maximization, Screening model, Water resources development, *River basins, Planning, Multiple-purpose reservoirs, Algorithms, Equations, Operations research.

Optimization models offer a valuable tool to the river basin planner. This report is the result of research in water resources multi-methodology. To solve the complex problems of simultaneous design and operation of reservoirs, much work has been accomplished in the joint use of optimization and simulation models, where the optimization model is used as a screening tool to identify a range of alternatives worthy of more detailed analyses to be carried out by the simulation model. The phase of this research reported herein concentrates on the derivation of an improved screening model, working with ReVelle's Linear Decision Rule (LDR) and Louck's Sequential Explicit Stochastic Linear Programming (SESLP) models. These two models are restructured and extended. A reformation of the SESLP models results in a substantial reduction in computational burden so that the models are now usable for realistic systems. The LDR model is extended to explicitly include economic benefits or losses. Energy generation is also considered for the first time in the LDR model and a new perspective on the water supply potential of a reservoir system is given. (See also W79-06186) (Bell Graf-Cornell)
W79-06185

OPTIMAL DESIGN AND OPERATION OF MULTI-RESERVOIR SYSTEMS: VOLUME II, ALTERNATIVE OPTIMIZATION MODELS OF THE LEHIGH RIVER BASIN,
Johns Hopkins Univ., Baltimore, MD.
M. H. Houck, and J. L. Cohon.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-262 018, Price codes: A08 in paper copy, A01 in microfiche. Prepared for National Science Foundation, Washington, D.C., Report No SAE-PDM-76-02, June 1976. 144 p, 46 fig, 48 ref.

Descriptors: *Reservoir design, *Reservoir operation, *Model studies, *Optimization, *Linear programming, *Stochastic processes, *Streamflow, *Simulation analysis, *Screening model, *Dynamic programming, *Chance-constrained programming, Lehigh River basin, Planning, Water policy, Water resources development, Costs, Water storage, Economics, Systems analysis.

This report is the result of research in water resources multi-model methodology. To solve the complex problems of simultaneous design and operation of reservoirs, much work has been accomplished in the joint use of optimization and simulation models, where the optimization model is used as a screening model to identify a range of alternatives worthy of more detailed analyses to be carried out by the simulation model. One phase of this research concentrated on the derivation of an improved screening model, emphasizing ReVelle's linear decision rule and Louck's stochastic linear programming model. The other major research task--the subject of this Volume II--was to develop an additional model for multi-model approaches to river basin planning, a policy model used for deriving optimal operating policies for the system developed by the screening model. The result would be a 'three-model' methodology, where the design from the screening model and the operating rules from the policy model would be fed into the simulation model for further analyses. This volume reports on the testing of various combinations of previously developed reservoir system models in order to identify reasonable methodologies. The models considered include: a mean year deterministic linear program, a multi-year deterministic linear program, a chance-constrained linear program, the sequential explicit stochastic linear program (Loucks), and a deterministic dynamic program. Each of these models was formulated, programmed, and solved for the Lehigh River Basin which presented rich data sources. The chance-constrained programming model using linear decision rule was found to be superior on the basis of all relevant criteria. (See also W79-06185) (Bell Graf-Cornell)
W79-06186

OLD WOMAN CREEK, OHIO: THE DESIGNATION OF A FRESHWATER ESTUARINE SANCTUARY,
Ohio Dept. of Natural Resources, Columbus.
For primary bibliographic entry see Field 6E.
W79-06301

GEOTHERMAL RESERVOIR SIMULATION 1. MATHEMATICAL MODELS FOR LIQUID- AND VAPOR-DOMINATED HYDROTHERMAL SYSTEMS,
Geological Survey, Reston, VA. Water Resources Div.
C. R. Faust, and J. W. Mercer.
Water Resources Research, Vol 15, No 1, p 23-30, February 1979. 4 fig, 25 ref.

Descriptors: *Geothermal studies, *Model studies, *Hydrothermal studies, *Mathematical models, *Thermal water, Porous media, Pressure, Enthalpy, Thermodynamics, Energy transfer, Steam, Hydrogeology, Equations.

Two alternative mathematical models are presented that are suitable for numerical simulation of geothermal reservoirs. The general mathematical model describes the three-dimensional flow of single-component water (both one and two phase) and the transport of heat in porous media. It is composed of two nonlinear partial differential equations, posed in terms of fluid pressure and enthalpy, and appropriate boundary conditions. An alternative quasi-three-dimensional model is derived by partial integration (in the vertical dimension) of the three-dimensional equations. The reservoir is assumed to have good vertical communication so that vertical equilibrium (gravity segregation) between steam and water is achieved. The resulting equations, posed in terms of vertically averaged pressure and enthalpy, include effects of an inclined, variable-thickness reservoir and mass and energy leakage to confining beds. (See also W79-06304) (Woodard-USGS)
W79-06303

GEOTHERMAL RESERVOIR SIMULATION 2. NUMERICAL SOLUTION TECHNIQUES FOR LIQUID- AND VAPOR-DOMINATED HYDROTHERMAL SYSTEMS,
Geological Survey, Reston, VA. Water Resources Div.
C. R. Faust, and J. W. Mercer.
Water Resources Research, Vol 15, No 1, p 31-46, February 1979. 13 fig, 4 tab, 44 ref.

Descriptors: *Geothermal studies, *Model studies, *Numerical analysis, *Hydrothermal studies, *Simulation analysis, Porous media, Vapor pressure, Enthalpy, Thermodynamics, Energy transfer, Hydrogeology, Equations, Evaluation.

Two numerical models are introduced for simulating three-dimensional, two-phase fluid flow and heat transport in geothermal reservoirs. The first model is based on a three-dimensional formulation of the governing equations for geothermal reservoirs. Since the resulting two partial differential equations, posed in terms of fluid pressure and enthalpy, are highly nonlinear and inhomogeneous, they require numerical solution. The three-dimensional numerical model uses finite difference approximations, with fully implicit Newton-Raphson treatment of nonlinear terms and a block (vertical slice) successive iterative technique for matrix solution. Newton-Raphson treatment of nonlinear terms permits the use of large time steps, while the robust iterative matrix method reduces computer execution time and storage for large three-dimensional problems. An alternative model is derived by partial integration (in the vertical dimension) of the three-dimensional equations. This second model explicitly assumes vertical equilibrium (gravity segregation) between steam and water and can be applied to reservoirs with good vertical communication. The resulting equations are posed in terms of depth-averaged pressure and enthalpy and are solved by a two-dimensional finite difference model that uses a stable sequential solution technique, direct matrix methods, and Newton-Raphson iteration on accumulation and source terms. (See also W79-06303) (Woodard-USGS)
W79-06304

SIMULATION OF STREAMFLOW OF ROCK RIVER AT LAKE KOSHKONONG, WISCONSIN, TO DETERMINE EFFECTS OF WITHDRAWAL OF POWERPLANT-COOLING WATER,
Geological Survey, Madison, WI. Water Resources Div.
W. R. Krug.
Geological Survey open-file report 79-253, January 1979. 21 p, 8 fig, 1 plate, 4 tab, 5 ref.

Descriptors: *Routing, *Streamflow, *Computer models, *Lakes, *Low flow, Consumptive use, Analytical techniques, Simulation analysis, Flow control, Nuclear powerplants, Diffusion, Thermal water, Cooling, *Wisconsin, *Rock River, *Lake Koshkonong.

A flow-routing model was used to simulate 44 years of stage data from Lake Koshkonong, Wis., and streamflow data from the Rock River downstream from the lake. The simulation was repeated for five possible degrees of consumptive use, ranging from zero to an annual average of 40 cubic feet per second. A minimum release rule was applied to the simulated operation of the dam at Indianford to guarantee at least the 7-day, 10-year low-flow discharge in the Rock River downstream from Lake Koshkonong. The simulated stage of Lake Koshkonong with consumptive use at 40 cubic feet per second was as much as 0.42 feet lower than the simulated stage with zero consumptive use for the same period. Duration of drawdown below the regulatory minimum stage of 11.8 feet, occurring

once in 10 years, increased from 83 to 132 days as consumptive use increased from 0 to 40 cubic feet per second. (Woodard-USGS)
W79-06315

FIELD VERIFICATION OF A ONE-DIMENSIONAL MATHEMATICAL MODEL FOR TRANSIENT COMPACTION AND EXPANSION OF A CONFINED AQUIFER SYSTEM,
Geological Survey, Sacramento, CA. Water Resources Div.
D. C. Helm.
In: ASCE Proceedings of the Specialty Conference on Verification of Mathematical and Physical Models in Hydraulic Engineering, College Park, Maryland, August 9-11, 1978, p 189-196, 1978. 6 fig, 2 tab, 9 ref.

Descriptors: *Land subsidence, *Pumping, *Groundwater, *Drawdown, *Computer models, Forecasting, Compaction, Water levels, Aquifer characteristics, Compressibility, Hydraulic conductivity, Hydrogeology, Permeability, Mathematical models, Aquifers, Confined water, Physical properties, Soil mechanics, Storage coefficient, Pressure, Simulation analysis, Evaluation.

Land subsidence due to ground-water withdrawal from a confined aquifer system is an expression at land surface of the net compaction at depth of the compressible layers within the system. Water-level fluctuations within coarse-grained aquifers produce boundary-stress changes on slow-draining compressible interbeds. A one-dimensional model has been applied to various field conditions ranging from a short-term test where 0.00048 meters of recoverable compaction (and subsequent expansion) of an overlying confining bed were measured during a 4-week aquifer test (including drawdown and recovery) to a long-term test where nearly 4 meters of subsidence occurred during 50 years of pumping overdraft. The model computes not only transient compaction and expansion at a site of interest but also the transient vertical distribution of preconsolidation pressure. This calculated stress distribution is used to estimate a critical depth to water needed either to initiate or to stop nonrecoverable compaction. Drawing on 15 sets of field data of stress and compaction, 15 sets of model values for average hydraulic conductivity and nonrecoverable compressibility are tabulated. Based on these estimated parameter values, future nonrecoverable compaction is predicted at each site for specified stress changes. (Woodard-USGS)
W79-06316

RECOMMENDATIONS FOR BASELINE RESEARCH IN WASHINGTON AND OREGON RELATIVE TO OFFSHORE RESOURCE DEVELOPMENT.
For primary bibliographic entry see Field 5C.
W79-06468

AN ANALYSIS OF THE FEASIBILITY OF SEPARATING EXPLORATION FROM PRODUCTION OF OIL AND GAS ON THE OUTER CONTINENTAL SHELF.
Office of Technology Assessment, Washington, DC.
Report May 1975. 227 p, 4 fig, 12 tab, 4 append, 7 attach.

Descriptors: *Resources development, Exploration, Production, *Outer Continental Shelf, *Oil and gas, Mid-Atlantic Bight, Southern California Bight, Gulf of Alaska, Leasing.

This study examines present practices and considers several alternative procedures by which exploration may be carried out prior to leasing and examines the advantages, disadvantages and uncertainties of each. The alternatives include three ranges of exploration effort--limited, intermediate, and full--by either government exploration teams or contracting industry teams through licensing procedures. The study keys on three of the twelve 'frontier' OCS areas as representative: the Mid-Atlantic (Baltimore Canyon), Gulf of Alaska, and Southern California. It appears feasible to separate exploration from production for the major prospects identified in the frontier areas in a limited or intermediate exploration program as defined in the report. However, since full exploration would require information obtained in the process of development and production of a region, it is probably not feasible or practical to conduct full exploration prior to production. Furthermore, OTA found that an intermediate program would merely be an extension of a limited program. Consequently, if separate exploration was desired, it could be initiated on a limited basis with the decision to extend to an intermediate level deferred. The analysis also found that, as certain benefits accrue from such a separation, it is likely that there will also be certain disadvantages or uncertainties of success, time loss and other impacts accruing from separation. These should be considered by policymakers in their deliberations. It should be noted further that there are possible alternatives to separation which could resolve, in part, the issues which raise the question of whether exploration should be separated from production. (Sinha-OEIS)
W79-06473

6B. Evaluation Process

HYDRONOMIC ANALYSIS: A METHOD FOR REGIONAL ANALYSIS OF ECONOMIC AND WATER RESOURCES RELATIONSHIPS,
Yale Univ., New Haven, CT. School of Forestry and Environmental Studies.
A. P. O'Hayre.
Journal of Environmental Management, Vol 7, No 2, p 125-146, September 1978. 7 fig, 2 tab, 36 ref. OWRT A-033-MINN(2). 14-34-0001-7050.

Descriptors: *Hydrodynamics, *Regional analysis, *Economics, *Water resources, *Input-output analysis, *Water quality, *Effects, *Simulation analysis, *Lakes, Eutrophication, Environmental control, Monte Carlo method, Land use, Forest management, Water pollution, Systems analysis, Equations, Mathematical models, Nonpoint source pollution, Spatial variation, Timber harvest, Pulp wood harvest, Itasca County(Minn).

Previous efforts to predict regional economic and environmental relationships have proposed the use of discharged residuals as environmental criteria. Others have attempted to use models to relate discharged residuals to environmental quality parameters, but these models fail to represent the spatial dimension of pollution discharge, especially regarding non-point sources of pollution. This study was an attempt to develop a more realistic simulation of regional economic and environmental quality relationships by modeling the regional distribution of lake water quality resulting from the spatial distribution of pollutants from non-point as well as point sources. An input-output economic model of Itasca County, Minnesota was modified so that the spatial variation in pollutants discharged in association with economic activity in the region could be assessed. A regional indicator of lake water quality was developed from the distribution of lake trophic state. Monte Carlo simulation was used to derive the distribution of trophic state from the distribution of lake characteristics, land use activities and point source discharge of nutrients. The lake water quality model was calibrated for Itasca County, using sub-regions within the county. The method was used to determine the effect of forest management alternatives on economic conditions and lake water quality in the region. The results suggest that expansion of timber harvest has a minimal effect on lake water quality as long as all the increased pulp wood harvest is exported from the region. (Bell Graf-Cornell)
W79-06001

CHOOSING A POTABLE WATER SUPPLY: WHAT YOU NEED TO KNOW,
New Jersey Inst. of Tech., Newark.
H. S. Hundal, R. B. Trattner, and P. N. Cheremisinoff.
Water and Sewage Works, Vol 126, No 3, p 78-80, March, 1979. 1 fig, 3 ref.

Descriptors: *Potable water, *Surface waters, *Ground water, Water sources, Water quality, Water treatment, Rivers, Lakes, Impoundments, Water harvesting, Aquifers, Water wells, Safe yield, Pumping, Artificial recharge, Springs, Infiltration galleries.

Various types of surface and subsurface sources of potable water are discussed in terms of their quality and treatment requirements. The quality of river water depends on the quantity of wastes discharged by upstream sources, and the volume flow of the river. Lakes and ponds generally have better, more uniform quality than rivers. An impoundment reservoir is an ideal source of potable water, requiring a minimum amount of treatment. Water harvesting uses catchment basins to collect runoff from precipitation and stores it in tanks designed to prevent seepage and evaporation losses. Groundwater is an important source, constituting about 97 percent of all freshwater. Minimal or no treatment is required and availability is relatively unaffected by droughts. An aquifer stores and transmits ground water in porous strata. If the pumping rate of a well penetrating an aquifer exceeds the recharge rate, the safe yield of the aquifer may be exceeded. In such cases, artificial recharge should be used. Springs water is usually free from bacteria or other harmful substances. Springs, like water wells, are of two types, gravity and artesians. The yields of gravity springs may be increased by constructing deep galleries across the direction of flow. (Purdin-NWWA)
W79-06008

WATER WELL MARKETS IN 1979,
E. A. Scott, Jr.
Ground Water Age, Vol. 13, No. 5, p 20, 27, 28, January, 1979.

Descriptors: *Economic prediction, *Water wells, Industrial production, Drilling, Marketing.

An economic forecast for key water well markets in 1979 is presented. Due to the cost of mortgage money, there will be a slight decline in new residential work, but to a far less extent than in similar periods in the past. Much of the slack caused by a decline in new residential jobs will be taken up by an expansion of the nonresidential market. This is due to an increase in the physical volume of commercial buildings and a trend toward the greater use of ground water in such construction. Water systems replacements will continue to grow during 1979. However, the rate at which pump replacements are growing may be slowing down due to more reliable equipment such as submersibles. New markets for the water well industry, most notably the ground-water source heat pump, will see further development in 1979. 1979 should be a banner year for the water well industry. (Purdin-NWWA)
W79-06017

DRILLERS AND INDUSTRY LEADERS LOOK AT 1979.
Ground Water Age, Vol. 13, No. 5, p 17-21, January, 1976. 1 tab.

Descriptors: *Economic prediction, *Surveys, *Drilling, Water wells.

The results of a survey of the economic outlook of 300 water well drilling contractors are presented in tabular and narrative form. The fourteen economic indices surveyed were: inflation, unemployment, gross income, net income, essential capital expenditures, discretionary capital expenditures, total expenses, administrative expenses, payroll expenses, total personnel, sales area personnel, technical personnel, and promotion. The opinions on the fourteen indices were in three categories: up over 1978, down from 1978, and little or no change. The contractors also gave verbatim reasons for their economic views. The most representative of these statements are presented for each of the fourteen indices. The overall opinion is that 1979 will be a good year for the water well drilling industry in spite of higher inflation and unemployment. (Purdin-NWWA)
W79-06018

IF YOU KNOW THE WEATHER YOU CAN PREDICT THE YIELD,
Clemson Univ., SC. Dept. of Horticulture.
For primary bibliographic entry see Field 2I.
W79-06035

ECONOMIC ASSESSMENT OF FGD SLUDGE DISPOSAL ALTERNATIVES,
Tennessee Valley Authority, Muscle Shoals, AL.
For primary bibliographic entry see Field 5E.
W79-06041

ENVIRONMENTAL ASSESSMENT GUIDANCE MUNICIPAL SEWAGE TREATMENT WORKS PROGRAM.
Environmental Protection Agency, Chicago, IL. Water Div.
For primary bibliographic entry see Field 5F.
W79-06095

AN ANNOTATED BIBLIOGRAPHY ON RIVER RECREATION.
North Central Forest Experiment Station, St. Paul, MN.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 689, Price codes: A04 in paper copy, A01 in microfiche. General Technical Report No NC-41, 1978. Compiled by Anderson, D. H., Leatherberry, E. C., and Lime, D. W. 64 p.

Descriptors: *Recreation, *Rivers, *Wild River Act, *Water resources development, *Bibliographies, Abstracts, Publications, Water sports, Access routes, Natural resources, Social aspects, Social impact, Wild rivers, Campsites, Recreational demand, Recreation facilities, Scenery, Tourism, Economics.

A compilation of available reference materials consisting of more than 300 listings which document various aspects of river recreation is presented. The bibliography is organized in nine parts; in each part the papers are arranged alphabetically according to author. All references are numbered since many references are cited in more than one part. The annotation of a reference appears in the first appropriate citation and subsequent citations are referenced by number at the beginning of all other relevant sections. Part 1 covers material pertinent to water resource management and research; Part 2 includes references on the role of river resources in outdoor recreation; Part 3 presents methods to inventory and classify river recreation resources; Part 4 cites economic methods to evaluate alternative uses of river resources; Part 5 presents articles describing investigations of the impacts people and recreational activity have on river resources; Part 6 focuses on how and by whom the river is used; Part 7 cites management of river resources; Part 8 contains an unannotated listing of all Federal legislation pertaining to the National Wild and Scenic Rivers Act of 1968; and Part 9 is an unannotated listing of selected guidebooks on rivers of North America. An author index is provided at the end of the bibliography. (Davison-IPA)
W79-06099

GEOGRAPHIC-ECONOMIC ASPECTS OF POLLUTION CONTROL SYSTEMS,
Ohio State Univ., Columbus. Dept. of Geography.
C. ZumBrunnen.
In: American-Soviet Symposium on Use of Mathematical Models to Optimize Water Quality Management. Kharkov and Rostov-on-Don, USSR, December 9-16, 1975. Environmental Research Laboratory, U.S. Environmental Protection Agency, Gulf Breeze, Fla., p 155-174 (Discussion p 175-179), September 1978. EPA-600/9-78-024. 4 fig, 21 ref.

Descriptors: *Water pollution control, *Geographic-economic aspects, *Territorial size, *Jurisdictional scale, *Water management(Applied), Optimization, Political aspects, Legal aspects, Cost-benefit analysis, Rivers, Lakes, Regions, Evaluation, Cost minimization, Marginal costs, Spatial impact.

This paper examines four considerations (questions) involved with water pollution. The first deals with the geographic-economic distribution or equity problems arising from either water pollution-generating activities or water pollution control problems; an attempt is made to apply benefit-cost concepts within a spatial context. The second section considers the issue of whether the mere territorial size or jurisdictional scale of a pollution control system enhances or impedes progress in achieving its abatement objectives. In other words, what are the inherent pros and cons associated with pollution control regions at various geographical scales. Investigated are the utility and disutility of the various scales of two types of water quality control regions, namely, political-administrative jurisdictions and natural regions such as river and lake basins. The third section briefly evaluates four broad strategies for water resource management: (a) moral suasion; (b) bargaining; (c) government regulation; and (d) economic inducments. Both of the last two water pollution control strategies are predicated upon governmental legislative action, but the latter is presumed to involve more decentralized decision making. Finally, current U.S. pollution control policies are reviewed. The paper addresses itself to legal, territorial, and economic strategies. Two implicit assumptions are: (1) the true price or value of pure water may be greater than both the U.S. and the USSR have assumed; and (2) the objective of any pollution control system should be to minimize the total costs of residual disposal which is achieved by equating the marginal costs of abatement and the marginal costs of pollution damages. (See also W79-06166) (Bell-Graf--Cornell)
W79-06172

THE RESPONSES OF THE LEGAL SYSTEM TO TECHNOLOGICAL INNOVATION IN AQUACULTURE: A COMPARATIVE STUDY OF MARICULTURE LEGISLATION IN CALIFORNIA, FLORIDA AND MAINE,
Massachusetts Inst. of Tech., Cambridge.
For primary bibliographic entry see Field 6E.
W79-06300

ECONOMIC IMPACT ANALYSIS OF A TRIHALOMETHANE REGULATION FOR DRINKING WATER. MCL OF THM AT 0.10 MILLIGRAMS/LITER FOR LARGE WATER SYSTEMS.
Temple Barker and Sloane, Inc., Wellesley Hills, MA.
For primary bibliographic entry see Field 6E.
W79-06351

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

THE USE OF EFFLUENT FEES TO REGULATE PUBLIC SECTOR SOURCES OF POLLUTION,
Princeton Univ., NJ. Dept. of Economics.
W. E. Oates, and D. L. Strassmann.
Journal of Environmental Economics and Management, Vol. 5, No. 3, p 283-291, September 1978. 2 fig, 14 ref.

Descriptors: *Economics, *Pollution taxes(Charges), *Regulation, *Public sector, *Pollution abatement, *Institutional constraints, Institutions, Bureaucracy, Federal government, Treatment plants, Municipal wastes, Powerplants, Weapons production, Costs, Optimization, Motivation, Incentives, Decision making, Financing, Budgeting, Policy, Niskanen model, Water pollution sources, Water pollution control, Effluents, Air pollution, Sewage disposal, Pollutants.

Pollution charges might induce public agencies to control and even reduce the amount of pollutants they introduce to the environment. Even though public agencies are organized on a non-profit basis and effluent charges assume profit-maximizing behavior by polluters, the nature of the budgeting/appropriations process in a bureaucracy makes this a feasible alternative. The analysis employs extended versions of the Niskanen model of bureaucratic behavior to determine the likely response of bureaucrats to effluent fees. Imposition of an effluent fee on a public agency can result in various outcomes: (1) the agency can request and receive a budgetary supplement from the legislature to cover the tax bill, and the pollution level will be unchanged; (2) the agency may be refused the supplement since it is presumably already receiving its maximum allocation, and it will be forced to reduce its level of pollution to meet costs; or (3) the agency may be granted the supplement but still have an incentive to shift less-polluting technology in order to increase prerequisites. This last possibility may be nullified, however, if there is a propensity to avoid the effort and complications of adopting new technology. All evidence shows public agencies to be major sources of pollution, including sewage, sulfur from power plants, and disposal of weapons production by-products. (Lynch-Wisconsin)
W79-06038

LOCATIONAL PRICING OF AN ENVIRONMENTAL INPUT,
Kansas Univ., Lawrence. Dept. of Economics.
K. Unger.
Journal of Environmental Economics, and Management, Vol. 5, No. 3, p 207-219, September 1978. 15 ref.

Descriptors: *Economics, *Effluents, *Water pollution sources, *Pricing, *Mathematical models, *Spatial distribution, Input-output analysis, Model studies, Rivers, Water quality standards, Industrial wastes, Municipal wastes, Policy, Externalities, Sites.

A model describes joint production of outputs and heterogeneous effluents for firms located along a river. Most analyses of externalities associated with joint use of an environmental input have been in spaceless economies in which all production and consumption are assumed to occur at a single site, and water quality, benefits, and costs are measured. That approach obscures the spatial nature of the supply of some environmental inputs. The location-specific pollution model is a water quality study for a fixed and finite number of firms or municipalities along a river. This study considers effluents heterogeneous, unlike most other models which reduce all effluents to biochemical oxygen demand. In the present analysis location-specific water quality standards are derived which reflect that upstream discharges impact strongly on downstream water users. Depending on the type of sequential firm interdependence, a water control agency may or may not be able to insure efficient input choices by decentralizing these choices to the firms. Under certain conditions, site-specific prices can be derived to reflect the socially imputed value of a particular type of effluent released at a given site. If each firm is assigned responsibility for cumulative water quality just below its drain pipe, then water quality control may be modelled as an application of nonsymmetrical recursive decision-making. (Lynch-Wisconsin)
W79-06039

SOME COMPLICATIONS IN THE MEASUREMENT OF ENVIRONMENTAL CONTROL IMPACTS: A CASE STUDY OF WATER POLLUTION CONTROLS,
Harvard Univ., Boston, MA. Graduate School of Business Administration.
For primary bibliographic entry see Field 6E.
W79-06042

SOUTHEAST CONFERENCE ON LEGAL AND ADMINISTRATIVE SYSTEMS FOR WATER ALLOCATION AND MANAGEMENT, VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY, BLACKSBURG, APRIL 19-20, 1978.
North Carolina State Univ. at Raleigh. Water Resources Research Inst.
For primary bibliographic entry see Field 6E.
W79-06051

THE MICROECONOMICS OF WATER SUPPLY AND DEMAND IN THE NORTHEASTERN UNITED STATES,
Pennsylvania State Univ., University Park. Dept. of Economics.
T. McHugh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 642, Price codes: A08 in paper copy, A01 in microfiche. Doctor of Philosophy dissertation, March 1979, 164 p, 8 fig, 16 tab, 59 ref, 4 append. OWRT C-3119 (No. 3688)(2), 14-31-0001-3688.

Descriptors: *Water supply, *Water demand, *Operating costs, Water rates, Model studies, *Pricing policy.

The main purpose was to develop a model of the essential operating characteristics of a water utility in the Northeastern United States. Past studies of the industry have tended to look at either the demand or the supply side--but not both. The 'model' utility was statistically estimated first by estimating demand and cost functions independently of one another and alternatively as a set of simultaneous equations. Data for the estimation process was provided by personal visits to each of the sample water suppliers and conducting in-depth interviews as part of a larger project involving all aspects of water supply and demand in the Northeast. The initial demand and cost functions obtained through independent estimating techniques (Ordinary Least Squares) lent credence to the simultaneous equation model in which the quantity purchased by residential customers, utility operating costs, and water price are viewed as being determined jointly within the system. The equations are then utilized to examine the effects of a change in pricing policy by the 'model' water suppliers on utility costs and revenues. (Sink-Penn State)
W79-06111

6D. Water Demand

GROUND-WATER CONDITIONS IN THE NAVAJO SANDSTONE IN THE CENTRAL VIRGIN RIVER BASIN, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
R. M. Cordova.
Utah Department of Natural Resources Technical Publication No. 61, 1978. 66 p, 15 fig, 3 plates, 8 tab, 15 ref.

Descriptors: *Groundwater resources, *Aquifer characteristics, *Well data, *Water yield, *Water quality, Pumping, Drawdown, Groundwater recharge, Hydrogeology, Water level fluctuations, Surface-groundwater relationships, Groundwater availability, Water supply, Water demand, Chemical analysis, Utah, *Virgin River basin, Navajo Sandstone.

The central Virgin River basin, Utah, includes about 1,000 square miles in the drainage basin of the Virgin River downstream from the Hurricane Cliffs. the Navajo Sandstone of Late Traiassic and Jurassic age crops out in 234 miles of the basin and underlies younger rocks in about 450 square miles of the basin. Interpretation of data were confined to the area of outcrop of the Navajo. Lithologically the formation is essentially a quartzose sandstone, about 2,000 feet in maximum thickness. Recharge to the Navajo Sandstone is estimated for 1974 to be a minimum of 17,000 acre-feet. Movement of ground water is generally from the Pine Valley Mountains, Bull Valley Mountains, and the area east of the Hurricane Cliffs toward the Virgin River and its tributaries. The overall direction of ground-water movement is independent of the strike or plunge of the large structural features. Discharge of ground water in 1974 amounted to a minimum of 19,000 acre-feet. The average effective porosity in the saturated zone is estimated to be 17 percent. The hydraulic conductivity has an average value of 2.1 feet per day based on laboratory analysis and 5 feet per day based on field tests. The maximum amount of water in storage available to wells is estimated to be 2.8 million acre-feet. Chemical analysis of the water in storage indicates that the concentration of dissolved solids range from 103 to 1,360 mg/L. (Woodard-USGS)
W79-06310

ECONOMIC IMPACT ANALYSIS OF A TRIHALOMETHANE REGULATION FOR DRINKING WATER. MCL OF THM AT 0.10 MILLIGRAMS/LITER FOR LARGE WATER SYSTEMS.
Temple Barker and Sloane, Inc., Wellesley Hills, MA.
For primary bibliographic entry see Field 6E.
W79-06351

6E. Water Law and Institutions

CALIFORNIA GROUNDWATER REPORT: IT'S FINALLY IN,
P. Call.
Pacific Ground Water Digest, Vol 2, No 3, p 17-19, March, 1979.

Descriptors: *Water law, *Water rights, *Legal review, Groundwater mining, Overdrafts, Water management(Applied), Water wells, Storage, Groundwater recharge, Judicial decisions, Legislation, Law enforcement, California.

The first comprehensive review of California water rights law since 1912 was completed by a commission consisting of university professors, water rights attorneys and former state legislators. The commission recommended a comprehensive groundwater management program enforced by state or local agencies. Overdrafts in some basins should be remedied by natural or artificial recharge and reducing the number of new wells drilled. The commission recommended clarification and streamlining of the groundwater adjudication process. The most controversial area of proposed legislation is the groundwater management section, due to enforcing powers which will be given to local managing districts. If passed, these new laws will have some effect on every area of California but especially on unregulated areas with overdraft problems. (Purdin-NWWA)
W79-06002

SOME COMPLICATIONS IN THE MEASUREMENT OF ENVIRONMENTAL CONTROL IMPACTS: A CASE STUDY OF WATER POLLUTION CONTROLS,
Harvard Univ., Boston, MA. Graduate School of Business Administration.
R. A. Leone.
Socio-Economic Planning Sciences, Vol 12, No 3, p 103-111, 1978. 5 fig, 5 tab, 5 ref.

Descriptors: *Water pollution control, *Regulation, *Industrial production, *Costs, *Economic impact, *Alternative planning, Theoretical analysis, Economics, Measurement, Industries, Governments, Pollution abatement, Alternative costs, Prices, Policy, Textiles, Pulp and paper industry, Oil industry, Metal finishing industry, Technology, Welfare(Economics), Discount rates, Management.

The impact on industry of environmental control regulations is defined as: (1) production cost changes induced by a policy action (primary impacts), and (2) competitive and distributional consequences of those cost changes (secondary impacts). Several complications arise in measuring primary impacts, including: (1) intertemporal and spatial variations in factor prices, (2) the discounting procedure cannot by itself account for future technological options, (3) managements may respond to regulations by reorganizing their operations, and (4) changes in processes or product mix. This paper focuses on water pollution control, but the discussion applies to almost any externally-induced and dicontinuous change in factor costs. Some problems addressed are: estimation of industry cost curves, economic criteria for identifying technical alternatives to be included in engineering studies of regulatory impact, choice of minimum cost abatement methods, sensitivity of findings to factor price changes, managerial criteria for selection of control methods, intra-industry disaggregation of impacts, and dynamic economic process of adjustment to controls. Methods demonstrated are microanalytical; examples include the textile, pulp and paper, petroleum refining, and metal finishing industries. Social questions regarding regulation effectiveness are not examined. Future costs incurred by industry from regulation will probably be lower than at present because of technical change and factor substitution. (Lynch-Wisconsin)
W79-06042

LEGAL ASPECTS OF FLOOD PLAIN MANAGEMENT,
North Carolina Univ. at Chapel Hill. Inst. of Government.
W. A. Campbell, and M. S. Heath, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 639, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute, University of North Carolina, Raleigh. Report No. 137, February 1979, 49 p. OWRT B-109-NC(1). 14-34-0001-8104.

Descriptors: *Flood plain management, Floodway, Droughts, Flood insurance, Flood protection, Land use, Legal aspects.

The federal flood insurance program has made it possible for landowners in flood hazard areas to obtain subsidized insurance protection against flood damages. As a condition of this protection, however, the local governments in which flood-prone land is located must adopt various restrictions on the use of land in the floodway and flood hazard areas. The North Carolina legislative center piece for authorizing local flood plain regulations is the Floodway Act. This act is deficient both in terminology and in scope of coverage when examined in the light of the federal requirements. To remedy these deficiencies it is recommended that the Act's coverage be broadened to include flood hazard areas beyond the floodway, to include areas of coastal flooding, and to delete the uses permitted as of right in the floodway. It is important for the state to play a major coordination and advisory role in land use regulation for flood protection. Local governments need technical assistance in preparing and administering the necessary regulatory measures, and the state has an important role to play in coordinating local efforts with the Federal Insurance Administrator and in generally overseeing the program. In addition, state property must meet the federal requirements in order for the state to obtain insurance or to qualify as a self insurer. Statutory changes are suggested to meet these needs. (Kiger-North Carolina)
W79-06049

SOUTHEAST CONFERENCE ON LEGAL AND ADMINISTRATIVE SYSTEMS FOR WATER ALLOCATION AND MANAGEMENT, VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY, BLACKSBURG, APRIL 19-20, 1978.
North Carolina State Univ. at Raleigh. Water Resources Research Inst.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 646, Price codes: A04 in paper copy, A01 in microfiche. Summary Report, Vol 1, No 1, 1978. 66 p. OWRT B-123-NC(1) and B-125-NC(1). 14-34-0001-9144, 14-34-0001-8134.

Descriptors: Water law, Water rights, Water administration, Water allocation, Land use, Interbasin transfer.

Conference objectives were: (1) to identify present and anticipated water allocation, use, and management problems in the Southeast as related to the present riparian reasonable use doctrine, (2) to analyze the adequacy of existing water law and administrative systems to cope with these problems, (3) to establish commonality of problems for sharing experiences and for identifying promising new legal and administrative approaches and research needs, and (4) to develop a responsive re-

gional action program. Water law and administration problems in Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia are discussed. Individual state summaries, conclusions, and recommendations are included. An overall regional summary includes recommendations for: a restudy of existing legal and administrative systems; clarification of water rights associated with non-riparian diversion and interbasin transfer; codification and recodification of state water law; improved state law and policies with respect to minimum streamflows, water shortages, hydrologic relationships between surface and groundwater, and land use relationships.
W79-06051

RURAL WATER AND SEWER SYSTEMS PROBLEMS, NEEDS, ISSUES, OPPORTUNITIES, AND GOALS,
National Rural Water Association, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 986, Price codes: A03 in paper copy, A01 in microfiche. Report No. EDA-065, August 1976. Proceedings, First National Organizational Conference of the National Rural Water Association, Oklahoma City, OK, April 15-16, 1976, 46 p.

Descriptors: *Water supply, *Water supply development, *Sewerage, *Financing, Sewage treatment, Legal aspects, Water pollution, Water treatment, Rural areas, Community development, Area redevelopment, Investment, Government finance, Maintenance, Management, Operation and maintenance, Technology.

The goals, problems and issues of rural water systems are set forth as defined by representatives of eight State Rural Water Associations, the organization meeting in Oklahoma City. The problems and issues of rural water supply and sewage systems are broadly categorized as financial, legal and jurisdictional, technological, operational and administrative, and educational and informational. The discussion includes analyses of the financial, jurisdictional and legal aspects, and system design, management, operation and maintenance. It is concluded that the socioeconomic and intergovernmental implications of both existing systems and demands for additional systems must be addressed, and that substantial public and private investments will be required during the next few years to meet the water and sewer needs in the rural areas and small towns of America. (Davison-IPA)
W79-06102

LAND AND WATER RESOURCES CONSERVATION ACT OF 1977,
Hearings, Subcommittee on Conservation and Credit, Committee on Agriculture, U.S. House of Representatives, on H. R. 75, March 1, 1977, Serial No. 95-U, 44 p.

Descriptors: *Conservation, *Land management, *Water conservation, *Legislation, Land resources, Land use, Water demand, Water management(Applied), Water pollution, Water quality, Water resources, Water policy.

This hearing before the U.S. House of Representatives Subcommittee on Conservation and Credit of the House Committee on Agriculture addresses the Land and Water Resources Conservation Act of 1977. In order to further the conservation of land, water, and related resources this act states the congressional policy that the conduct of programs administered by the Secretary of Agriculture for this purpose should be responsive to the long-term needs of the nation. This policy is to be implemented by: (1) appraising on a continuing basis the land, water and related resources of the nation; (2) developing and updating periodically a program for furthering the conservation, protection and enhancement of the land, water and related resources of the nation; and (3) providing to Congress and the public, through continuing reports, the information developed pursuant to paragraphs (1) and (2) as stated above, and by providing Congress with an annual evaluation report. Appearing before the subcommittee were representatives of: the Sierra Club; the National Association of Conservation Districts; the Soil Conservation Society of America; and the National Wildlife Federation. All verbatim testimony is included. (Goldberg-Florida)
W79-06293

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION ORGANIC ACT.
Hearings, Committee on Commerce, Science, and Transportation, U.S. Senate, on S. 2224, April 6, 1978, Serial No. 95-88, 81 p.

Descriptors: *Oceans, *Legislation, *Planning, *Priorities, Atmosphere, Political aspects, Coastal engineering, Coasts, Water resources development, Water policy, Environmental effects.

The hearing before the United States Senate Committee on Commerce, Science, and Transportation addressed Senate Bill 2224. The purpose of this bill is to establish a national ocean policy and to set forth the missions of the National Oceanic and Atmospheric Administration (NOAA). The bill designates the NOAA as the lead civilian agency with responsibility for coordinating and carrying out national ocean policy in order to improve the understanding, assessment, development, utilization, conservation and protection of ocean and coastal resources and the atmosphere. The bill states the Congressional policy that the federal government utilizes its capabilities to create and maintain conditions under which ocean, coastal, and atmospheric resources may be utilized without harming the environment so as to fulfill the needs of present and future generations. Also contemplated is the efficient dissemination of atmospheric and oceanographic research and technology to the states, local governments and the private sectors as well as other federal agencies. All testimony received by the committee is reproduced verbatim. (Goldberg-Florida)
W79-06294

WETLANDS PROTECTION: THE REGULATORY ROLE OF THE UNITED STATES ARMY CORPS OF ENGINEERS,
L. D. Wood, and J. R. Hell, Jr.
Coastal Zone Management Journal, Vol. 4, p 371-404, 1978.

Descriptors: *Wetlands, *Regulation, *Land development, *Engineering, Permits, Dredging, Marshes, Swamps, Coasts, Estuaries, Judicial decisions, Planning.

Until recently, people ascribed little value to marshy lands that could not be farmed or otherwise developed. However, modern science has demonstrated the great importance of wetlands, in both environmental and economic terms. These valuable functions are discussed briefly. The U.S. Army Corps of Engineers administers the only nationwide regulatory program that controls development activities in United States waters and wetlands. The program regulates the issuance of permits to private parties for activities involving wetlands property. The statutory authorities, jurisdictional limitations, and evolution of the current corps regulations, which express a strong policy to protect wetlands, estuaries, and tidal waters from unnecessary dredging, filling, or other alterations are examined. The organization and procedures of the Corps of Engineers are explained and several important permit cases which have developed and implemented the Corps' wetlands policy are also detailed. Current and potential policies underlying the Corps' regulatory efforts are evaluated. The author concludes that the wisest policy for now is to permit alteration of wetlands only when that is clearly necessary to attain public benefits which cannot be attained otherwise. (Horwich-Florida)
W79-06295

INTERGOVERNMENTAL COMPLEXITY AND COASTAL ZONE MANAGEMENT,
New York Univ., NY. Graduate School of Public Administration.
R. L. Sparrow.
Coastal Zone Management Journal, Vol. 4, No. 4, p 363-70, 1978.

Descriptors: *Governmental interrelations, *Coasts, *Planning, *Political aspects, Management, Government finance, Shore protection, Federal jurisdiction, State governments, Local governments, Federal government, Priorities.

The primary purpose of the Coastal Zone Management Act of 1972 (CZMA) and its substantial amendments of 1976, is to initiate coastal zone management practices by means of stimulating state and local activity. Political scientists and political decision-makers have long recognized the difficulty in a federal system of determining the most appropriate jurisdictional level for a given policy activity. The CZMA, straddles the fence regarding the centralization-decentralization jurisdictional dispute. The consequence of this pattern of dispersal of authority will be relative inattention to long-term considerations, such as conservation and preservation. The potential for conflict over the use of the coastal zone is increasing. The basic difficulty is that the law itself is inconsistent in providing for the promotion of goals which are esentially conflicting. Since the problems that engender conflict in this area will not diminish in coming decades, and since the disputants include governmental as well as private forces, the likelihood exists for greater federal involvement whenever the level of conflict exceeds the bounds of existing, decentralized procedures. (Fortin-Florida)
W79-06296

FEDS PUSH FOR WHOLLY INTEGRATED STATE/EPA PROGRAMS,
For primary bibliographic entry see Field 5G.
W79-06297

COMPLYING WITH THE FLOOD DISASTER PROTECTION ACT,
Pennsylvania State Univ., State College.
B. L. Myers, and J. K. Ruben.
Real Estate Law Journal, Vol. 7, No. 2, p 114-131, 1978.

Descriptors: *Flood plains, *Flood plain zoning, *Flood plain insurance, *Local governments, Legislation, Flood control, Federal government, Regulation, Construction, Land use, Land development.

The most significant aspect of the National Flood Insurance Program contained in the Flood Disaster Protection Act of 1973 (Act) is that, if stringent land use controls are not enacted by local or state governments for flood-prone areas, no flood insurance will be made available to residents of such communities. In addition, no money for property acquisition, construction, or development from federal agencies will be made available in the designated 100-year flood plain. In order for individuals to benefit from this program their community must first become an 'eligible community' by complying with federal Housing and Urban Development codes and ordinances. Though no overt sanctions were included in the program, the lack of availability of flood insurance, as well as the withholding of certain federal funds, were expected to encourage compliance with the Act. Amendments are currently being considered which would mean effectively imposed sanctions on those individuals who do not comply with the Act while elminating sanctions against those where are in compliance. (Goldberg-Florida)
W79-06299

THE RESPONSES OF THE LEGAL SYSTEM TO TECHNOLOGICAL INNOVATION IN AQUACULTURE: A COMPARATIVE STUDY OF MARICULTURE LEGISLATION IN CALIFORNIA, FLORIDA AND MAINE,
Massachusetts Inst. of Tech., Cambridge.
S. Owen.
Coastal Zone Management Journal, Vol. 4, No. 3, p 269-94, 1978.

Descriptors: *Aquaculture, *Legislation, *Leases, *Technology, Marine animals, Marine plants, Coasts, Cultivation, Competing uses, Florida, California, Maine.

Aquaculture has been defined as the culture or husbandry of aquatic animals or plants for commercial purposes or to augment natural stocks. Salt-water aquaculture (mariculture) legislation in most states restricts the leasing of coastal waters for specific, existing technologies. Legal responses to innovations has been cautious and piecemeal. But legislation in California, Florida, and Maine represents a more flexible approach to accommodating new technologies. These states' legislation is broadly drafted, and provides for the leasing of coastal areas and use of the vertical water column for any type of aquaculture activity. While this represents a policy decision which would appear to encourage future innovation, the author examines the implications of such a policy and warns that there are a number of complex issues to be resolved in order for states to achieve the desired results. The failure of these states to respond fully to these issues may inhibit aquaculture innovation or unduly restrict nonaquaculture uses of the coastal zone. For example, the effects of minimum time periods or maximum tract sizes of leases are discussed, as are legislative drafting problems and rights of conflicting interest groups. (Horwich-Florida)
W79-06300

OLD WOMAN CREEK, OHIO: THE DESIGNATION OF A FRESHWATER ESTUARINE SANCTUARY,
Ohio Dept. of Natural Resources, Columbus.
D. P. Hanselmann, and T. L. Vogel.
Coastal Zone Management Journal, Vol 4, No 3, p 329-35, 1978. 2 fig.

Descriptors: *Estuaries, *Great Lakes region, *Coastal marshes, *Ohio, Beaches, Marshes, Administrative agencies, Administrative decisions, Estuarine environment, Great Lakes, Freshwater marshes, Preservation.

Although much of Ohio's Lake Erie shoreline is highly developed, one section is a relatively undisturbed representative of freshwater estuaries found around the Great Lakes. This section is located at the mouth of Old Woman Creek in Erie County. In 1975, the Ohio Department of Natural Resources (ODNR) applied to the federal Office of Coastal Zone Management (OCZM) for an estuarine sanctuary grant. The purpose of such a sanctuary is to ensure the long-term protection of a freshwater estuary for the study of both the natural relationships within the ecosystem and of human impact, and for public education programs that emphasize the value of estuaries. The proposed 637-acre sanctuary is comprised of four general landscape types: marshland, woodlands, open fields, and a barrier beach. Development of sound management plants is essential to the long-term scientific/interpretational use and protection of the proposed estuarine sanctuary. The agency submitting the grant application should realize: the need to involve all affected and interested parties at an early planning stage; that the grant process may be a lengthy one; and that compromises and plan modifications may be necessary in boundaries and management plans. (Fortin-Florida)
W79-06301

THE EXCLUSIVE ECONOMIC ZONE AS A CONCEPT IN INTERNATIONAL LAW,
J. C. Phillips.
International & Comparative Law Quarterly, Vol. 26, No. 3, p 585-618, July, 1977.

Descriptors: *United Nations, *Conferences, *International waters, *International law, Oceans, Economics, Fish conservation, Shore protection, Environmental control, Continental shelf, Boundaries(Surfaces), Beds under water.

The Third United Nations Conference on the Law of the Sea was characterized by the failure of the international community to agree on any precise legal regime for the oceans. One of the suggestions that was regarded as likely to form a basis of agreement was the concept of the exclusive economic zone. An exclusive economic zone has been defined as an area beyond and adjacent to the territorial sea in which a State has sovereign rights for the purpose of exploring, exploiting, conserving and managing the natural resources, whether renewable or non-renewable, of the bed, subsoil and superadjacent waters. The sovereign rights of the coastal state pertain only to the resources of the zone rather than the zone itself. Problems that attend such a concept are: (1) the difficulty of delimiting the zone between adjacent states; (2) whether small islands should be entitled to an economic zone of their own; and (3) whether the jurisdiction of coastal states is far too extensive in regard to control over fishing resources as to control over which countries may fish in its economic zone. (Goldberg-Florida)
W79-06302

ECONOMIC IMPACT ANALYSIS OF A TRIHALOMETHANE REGULATION FOR DRINKING WATER. MCL OF THM AT 0.10 MILLIGRAMS/LITER FOR LARGE WATER SYSTEMS.
Temple Barker and Sloane, Inc., Wellesley Hills, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 813, Price codes: A07 in paper copy, A01 in microfiche. Report August 1977. 124 p, 6 fig, 52 tab, 4 append.

Descriptors: *Economic impact, *Water quality standards, *Organic compounds, *Water quality control, *Analytical techniques, Cost analysis, Costs, Water treatment, Human population, Treatment facilities, Regulation, Monitoring.

An analysis considered the economic impacts of reducing the maximum contaminant level (MCL) of trihalomethanes in potable water to 0.10 mg/liter at treatment plants serving 75,000 people. The regulation proposed would also require plants serving 10,000-75,000 people. The regulation proposed would also require plantsserving 10,000-75,000 people to monitor trihalomethane levels. The analytic structure identifies regulatory criteria, the number of community water systems affected by the regulation, the available treatment alternatives, and a profile of systems' response to MCL regulation. Cost analyses of the regulation include national cost estimtes, costs to typical systems, and monitoring costs. Variables considered in the economic analysis include varying the mix of treatments which systems would select, varying the MCL, and including system size boundaries above and below the 75,000 population mark. The impacts on the industries supplying granular activated carbon, regeneration furnaces, chlorine dioxide, ozonators, and ammonia for treatment of water under the proposed regulation are also considered. Appendices provide methodology and modelling procedures, water quality data, treatment costs and sensitivity analysis, and regulatory compliance strategies. (Lisk-FIRL)
W79-06351

6G. Ecologic Impact Of Water Development

ENVIRONMENTAL ASSESSMENT GUIDANCE MUNICIPAL SEWAGE TREATMENT WORKS PROGRAM.
Environmental Protection Agency, Chicago, IL. Water Div.
For primary bibliographic entry see Field 5F.
W79-06095

FINAL EIS GREENSBORO-GUILFORD COUNTY, N.C. 201 WASTEWATER TREATMENT SYSTEM PROJECT NO. C37037601.
Environmental Protection Agency, Atlanta, GA. Region IV.
For primary bibliographic entry see Field 5D.
W79-06345

7. RESOURCES DATA

7A. Network Design

GREAT LAKES RESEARCH ADVISORY BOARD ANNUAL REPORT TO THE INTERNATIONAL JOINT COMMISSION,
For primary bibliographic entry see Field 5G.
W79-06125

THE IMPACT OF COMPOSITE SAMPLING AND OTHER DATA AGGREGATION PROCEDURES ON POLLUTION DETECTION IN THE PULP AND PAPER INDUSTRY,
British Columbia Univ., Vancouver.
H. D. Drechsler, and P. N. Nemetz.
Canadian Journal of Forest Research, Vol. 8, No. 3, p 328-340, September, 1978. 9 fig, 11 ref, 45 tab.

Descriptors: *Pulp and paper industry, *Water pollution, *Sampling, Water pollution sources, Canada, Foreign countries, Monitoring, Data collections, Effluents, Discharge(Water), British Columbia(Canada).

The inadequacy of current procedures for the measurement and analysis of effluent data are demonstrated. The deficiencies of these procedures are illustrated using as an example the British Columbia pulp and paper industry. Four factors have been identified which restrict the ability of various monitoring systems to detect the presence and severity of excessive effluent discharges. These factors are the significant information losses associated with current grab and composite sampling techniques, the units of measurement presently required for the assessment of effluent quality, the infrequency of compliance monitoring, and information losses associated with statistical aggregation procedures used in the compilation and analysis of effluent data. (Witt-IPC)
W79-06141

CLIMATOLOGICAL ESTIMATES OF LAKE EVAPORATION,
Department of the Environment, Ottawa (Ontario). Hydrology Research Div.
For primary bibliographic entry see Field 2D.
W79-06261

7B. Data Acquisition

TV INSPECTION LOCATES LIBYAN WATER WELL PROBLEMS,
Underground Surveys Corp., Fresno, CA.
R. DeLenikos.
Irrigation Journal, Vol 29, No 1, p 31, January-February, 1979.

Descriptors: *Water wells, *Inspection, Irrigation, Equipment, Well screens, Sands, Separators, Pumps, Telemetry, Rehabilitation, Downhole cameras.

Over 200 irrigation wells serving a large agricultural area in Libya were quickly and accurately inspected with a down-hole television system specially prepared for desert transport. The television survey revealed that most of the performations were plugged with mud while the remaining perforations were causing high entrance velocities and forcing in the sand. An eight inch stainless steel well screen with a sixteen inch production casing was installed and a separator was installed on the pump discharge to reduce the sand content. (Purdin-NWWA)
W79-06004

NEW LIFE FOR TERMINAL WELLS,
For primary bibliographic entry see Field 8A.
W79-06005

MEASURING FLUMES OF SIMPLIFIED CONSTRUCTION,

Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
J. A. Replogle, and A. J. Clemmens.
Paper No. 78-2506, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, IL. 13 p. 10 fig, 3 tab, 15 ref. ASAE, St. Joseph, Michigan.

Descriptors: Flumes, Measurement, Mathematical models, Flow measurement, Irrigation canals, Critical flow, Construction costs.

Mathematical modeling was applied to optimize error control and construction simplicity for the selection of a family of long-throated flumes, resembling broad-crested weirs with a sloping approach ramp, for use in trapezoidal irrigation canals. Alternate shapes and sizes were proposed for unlined canals with extensions to sizes and shapes for limited application to watershed work. (Skogerboe-Colorado State)
W79-06028

SAMPLING AND PRESERVATION TECHNIQUES FOR WATERS IN GEYSERS AND HOT SPRINGS,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 2F.
W79-06064

HF SURFACE-CURRENT MAPPING RADAR 1977 ALASKAN OPERATIONS--LOWER COOK INLET,
National Oceanic and Atmospheric Administration, Boulder, CO. Wave Propagation Lab.
D. E. Barrick.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol IX, Transport, p 1-20, October 1978. 14 fig. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Mapping, *Circulation, *Ocean currents, *Radar, *Baseline studies, Oil spills, Water pollution effects, Environmental effects, Resources development, Alaska, *Outer Continental Shelf, *Oil transport, Cook Inlet.

The objectives of the initial Alaskan experiments in the summer of 1977 were: (1) to demonstrate the feasibility and utility of a transportable HF radar system for operational near-real-time mapping of surface currents in remote coastal areas, and (2) to gather environmental baseline data on surface circulation around Kachemak Bay in the Lower Cook Inlet. By presenting sample radar-produced current maps at two opposing periods in the tidal cycle and comparing these data with drifter buoy velocity measurements, the credibility of the claim is established that such systems can play a major role in future coastal current-data gathering studies. Results show that: (1) a single current-vector map covering thousands of square kilometers can be produced after 15 minutes operation; (2) at least three orders of magnitude more data can be gathered in a given twelve-hour period than by any alternative technique; (3) the system rms error is at worst one-half knot (current velocity), and most likely considerably better. (Sinha-OEIS)
W79-06187

OPERATION OF AN ALASKAN FACILITY FOR APPLICATIONS OF REMOTE-SENSING DATA TO OCS STUDIES,
Alaska Univ., Fairbanks. Geophysical Inst.
A. E. Belon.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol X, Transport, p 260-291, October 1978. 10 fig. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-55.

Descriptors: *Monitoring, *Remote-sensing, *Sea ice, *Oil spills, *Geomorphology, Offshore platforms, Baseline studies, Hazards, Environmental effects, Meteorology, Forecasting, Alaska, *Outer Continental Shelf, Petroleum development, Petroleum transport.

The acquisition of remote-sensing data, especially satellite data, has proved to be a cost-effective method of monitoring the environment on a synoptic scale. Meteorological satellites have been used for over a decade to study weather patterns and as an aid to weather forecasting. The morphology and dynamics of sea-ice which are relevant to navigation and construction of offshore structures, the patterns of sediment transport and sea-surface circulation which will aid to forecast trajectories of potential oil spills and impact on fisheries, the nature of ecosystems in the near-shore regions which can be changed by human activity, are among the critical development-related environmental parameters which can be studied, in conjunction with appropriate field measurements, and eventually routinely monitored by remote-sensing. (Sinha-OEIS)
W79-06200

DEVELOPMENT AND OPERATION OF A REMOTE SENSING DATA ACQUISITION PLATFORM FOR OCS STUDIES,
Naval Arctic Research Lab., Barrow, AK.
M. Frank, and G. A. Laursen.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for the Year Ending March 1978, Vol X, Transport, p 835-852, October 1978. 4 fig. NOAA, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Remote sensing, *Radar, *Aircraft, *Oil spills, *Mapping, Sea ice, Baseline studies, Environmental effects, Path of pollutants, Resources development, Water pollution, Alaska, *Outer Continental Shelf, *Oil transport, Side looking airborne radar(SLAR), North Slope(AK), Petroleum development.

The primary objective of the proposed program is to establish, operate and maintain a remote sensing data acquisition system using primarily side looking airborne radar (SLAR), a precision radiation thermometer (PRT-5) and aerial photomapping cameras. The SLAR has been installed into the dedicated NARL aircraft C117-D in a modular configuration. SLAR imagery is easily obtained through most weather conditions. It becomes a potentially important tool for determining the magnitude of an oil spill under sea ice. It can then be used to map the movements of oil slicks as they are moved by currents and winds. The precision radiation thermometer (PRT-5), or remote thermometer, measures the effective emission-surface temperature using broad spectrum infrared. Pointedly, ground, snow surface, water, oil slick and oil seep temperatures can be determined quickly and with a high degree of accuracy. (Sinha-OEIS)
W79-06209

EFFECTS OF CHANNEL DAMS ON DISSOLVED OXYGEN CONCENTRATIONS IN NORTHERN ILLINOIS STREAMS,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 5G.
W79-06234

INTERPRETATION OF WELL LOGS IN A CARBONATE AQUIFER,
Geological Survey, Denver, CO. Water Resources Div.
L. M. MacCary.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 508, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-88, July 1978. 30 p, 12 fig, 4 tab, 10 ref.

Descriptors: *Logging(Recording), *Borehole geophysics, *Electrical well logging, *Radioactive well logging, Aquifers, Carbonates, Analytical techniques, Aquifer characteristics, Evaluation, Texas, *Edwards aquifer, Well log analysis, Cross plot methods, M and N plots, Pattern recognition methods.

Geophysical logs from two core holes in the Edwards aquifer in Texas were analyzed and the results compared to other geologic and hydrologic data obtained from well tests and core studies. The acoustic velocity, sidewall neutron, and density logs are especially useful in the study of carbonate aquifers because porosity, secondary porosity, rock composition, and bulk density can be determined from them. Under some conditions, deeply focused resistivity logs can be used to calculate formation water resistivity and the cementation exponent. The log analysis methods described can be applied to other carbonate systems by hand plotting and a few simple calculations which can be performed on a pocket calculator. The hydrologist is advised of specific criteria which his logs must meet in order to derive maximum value from the analysis. (Woodard-USGS)
W79-06312

THE EFFECT OF LIQUID WASTE DISCHARGES FROM STEAM GENERATING FACILITIES,
Battelle Pacific Northwest Lab., Richland, WA.
For primary bibliographic entry see Field 5C.
W79-06357

ODOR ASSESSMENT FOR SEWAGE SLUDGE SAMPLES 300A01002,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 5D.
W79-06364

FLOW MEASUREMENT USING A CONDUCTIVITY FLOW METER--INITIAL INVESTIGATION,
Department of Scientific and Industrial Research, Taupo (New Zealand). Ecology Div.
P. H. John, F. A. Johnson, and P. Sutcliffe.
Journal of Hydrology (New Zealand), Vol 17, No 1, p 16-30, 1978. 7 fig, 2 tab, 13 ref.

Descriptors: *Flow, *Flowmeters, *Flow measurement, *Instrumentation, Current meters, Channel flow, Streamflow, Closed conduit flow, Laboratory tests, Tracers, Salts, Sodium compounds, Electrical conductance, Measurement, Velocity, Hydrology, *Conductivity flowmeters.

The limitations of existing salt velocity flow measurement techniques were reviewed, and the use of a new automatic method called the Conductivity Flow Meter was described. During trials in a laboratory flume, the variables associated with the new system were examined to assess their effect on performance, and a series of tests was carried out to investigate the precision and accuracy of the meter. The results showed the Conductivity Flow Meter to compare favorably with other salt-velocity techniques and current meters and indicated that it could find wide application in flow measurement both in closed conduits and open channels. (Sims-ISWS)
W79-06419

A PRINTING COUNTER FOR THE FIELD RECORDING OF EVENTS,
Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Chemistry Div.
J. E. Patterson.
Journal of Hydrology (New Zealand), Vol 17, No 1, p 31-38, 1978. 7 fig, 6 ref.

Descriptors: *Logging(Recording), *Equipment, *Instrumentation, On-site investigations, Hydrologic data, Meteorological data, On-site data collections, Solar radiation, Soil moisture, Temperature, Rainfall, Winds, Flow, Electronic equipment, Printing counters, Recorders.

A novel, low-cost housing for a single-channel Swiss printing counter mechanism allows recording of some hydrological and meteorological variables under a variety of field conditions. A range of accessories has been developed for recording solar

radiation, soil moisture, and average temperatures. Variables such as rainfall, wind run, water flow, etc., may be recorded by using the appropriate transducer. (Sims-ISWS)
W79-06420

7C. Evaluation, Processing and Publication

NUMERICAL MODELLING OF AN AQUIFER SYSTEM WITH INTERMITTENT RECHARGE,
James Cook Univ., North Queensland (Australia). Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W79-06020

WATER RESOURCES DATA FOR LOUISIANA, WATER YAR 1978--VOLUME 1. CENTRAL AND NORTHERN LOUISIANA.
Geological Survey, Baton Rouge, LA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 412, Price codes: A18 in paper copy, A01 in microfiche. Geological Survey Water-Data Report LA-78-1, December 1978. 412 p, 9 fig.

Descriptors: *Louisiana, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Central and northern Louisiana.

Water resources data for the 1978 water year for Louisiana consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. The report, in three volumes, contains discharge records for 76 gaging stations; stage records for 66 of these gaging stations; stage only for 32 gaging stations; contents for 1 reservoir; state only for 12 lakes; water quality for 22 gaging stations, 35 ungaged sites, 80 miscellaneous sites, 10 lakes, and 169 wells; and water levels for 696 observation wells. Also included are 199 crest-stage partial-record stations and flood-profile partial-record stations. Additional water data were collected at various sites, not involved in the systematic data-collection program, and are published as miscellaneous measurements. Records for a few pertinent stations in bordering States also are included. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Louisiana. (Woodard-USGS)
W79-06305

WATER RESOURCES DATA FOR LOUISIANA, WATER YEAR 1978--VOLUME 2. SOUTHERN LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 534, Price codes: A16 in paper copy, A01 in microfiche. Geological Survey Water-Data Report LA-78-2, January 1979. 365 p, 13 fig.

Descriptors: *Louisiana, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Southern Louisiana.

Water resources data for the 1978 water year for Louisiana consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. The report, in three volumes, contains discharge records for 76 gaging stations; stage records for 66 of these gaging stations; stage only for 32 gaging stations; contents for 1 reservoir; stage only for 12 lakes; water quality for 22 gaging stations, 35 ungaged sites, 80 miscellaneous sites, 10 lakes, and 169 wells; and water levels for 696 observation wells. Also included are 199 crest-stage partial-record stations and flood-profile partial-record stations. Additional water data were collected at various sites, not involved in the systematic data-collection program, and are published as miscellaneous measurements. Records for a few pertinent stations in bordering States also are included. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Louisiana. (Woodard-USGS)
W79-06306

WATER RESOURCES DATA FOR LOUISIANA, WATER YEAR 1978--VOLUME 3. COASTAL LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 535, Price codes: A15 in paper copy, A01 in microfiche. Geological Survey Water-Data Report LA-78-3, January 1979. 326 p, 5 fig.

Descriptors: *Louisiana, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Coastal Louisiana.

Water resources data for the 1978 water year for Louisiana consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and quality of ground water. The report, in three volumes, contains discharge records for 76 gaging stations; stage records for 66 of these gaging stations; stage only for 32 gaging stations; contents for 1 reservoir; stage only for 12 lakes; water quality for 22 gaging stations, 35 ungaged sites, 80 miscellaneous sites, 10 lakes, and 169 wells; and water levels for 696 observation wells. Also included are 199 crest-stage partial-record stations and flood-profile partial-record stations. Additional water data were collected at various sites, not involved in the systematic data-collection program, and are published as miscellaneous measurements. Records for a few pertinent stations in bordering States also are included. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Louisiana. (Woodard-USGS)
W79-06307

HYDROLOGIC MONITORING IN THE AREA OF THE TENNESSEE-TOMBIGBEE WATERWAY, MISSISSIPPI-ALABAMA, FISCAL YEAR 1978,
Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 2A.
W79-06311

HYDROLOGIC, GEOLOGIC, AND WATER-QUALITY DATA, OCHLOCKONEE RIVER BASIN AREA, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
C. A. Pascale, J. R. Wagner, and J. E. Sohm.
Geological Survey Water-Resources Investigations 78-97 (open-file report), August 1978. 515 p, 4 fig, 15 tab, 18 ref.

Descriptors: *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Data collections, Gaging stations, Rain gages, Water wells, Aquifer characteristics, Hydrogeology, Well data, Water yield, Water levels, Water analysis, Chemical analysis, Florida, *Ochlockonee River basin.

This report presents hydrologic, geologic, and water-quality data collected within the Ochlockonee River basin area, in the panhandle of northwest Florida. The data are presented in graphs and tables. Surface-water data include streamflow measurements and analyses of water collected at 58 sites; ground-water data include descriptions of 360 wells and core holes, analyses of water and hydrographs of selected wells, lithologic logs of 131 wells and test borings, and natural-gamma logs of selected wells ranging in depth from 110 to 1,346 feet. Rainfall and municipal pumpage data also are compiled. Maps show the location of the data-collection sites. (Woodard-USGS)
W79-06318

ARSENIC, NITRATE, IRON, AND HARDNESS IN GROUND WATER, FAIRBANKS AREA, ALASKA,
Geological Survey, Anchorage, AL. Water Resources Div.
For primary bibliographic entry see Field 5B.
W79-06320

LOW-FLOW FREQUENCY OF MINNESOTA STREAMS,
Geological Survey, St. Paul, MN. Water Resources Div.
S. A. Warne.
Geological Survey Water-Resources Investigations 78-132 (open-file report), 1978. 1 sheet, 4 fig, 5 ref.

Descriptors: *Low flow, *Frequency analysis, *Streamflow, *Maps, *Minnesota, Base flow, Gaging stations, Flow characteristics.

Flow-frequency data for Minnesota streams are presented in atlas form for 161 gaging stations and about 300 partial-record stations for 7-day low flows with 2- and 10-year recurrence intervals. The report also discusses the factors that influence low flow and shows that the magnitude of low flows generally increases from west to east in Minnesota. (Woodard-USGS)
W79-06321

WATER AVAILABILITY, CLEBURNE COUNTY, ALABAMA,
Geological Survey, University, AL. Water Resources Div.
R. V. Chandler, and G. C. Lines.
Alabama Geological Survey Map 143, 1978. 29 p, 9 fig, 4 tab, 21 ref.

Descriptors: *Available water, *Surface waters, *Groundwater resources, *Water quality, Hydrologic budget, Water supply, Maps, Streamflow, Flow rates, Water storage, Lakes, Reservoirs, Aquifers, Water yield, Groundwater availability, Water wells, Hydrogeology, Water analysis, Chemical analysis, *Alabama, *Cleburne County(Ala).

In Cleburne County, Alabama, large quantities of surface water are available from the Tallapoosa and Little Tallapoosa Rivers. The Tallapoosa River near Heflin has an average flow of about 410 Mgal/d (million gallons per day). The Little Tallapoosa River has an average flow of about 300 Mgal/d where it enters the county. Surface water stored in lakes and farm ponds in the county is estimated to be 2,000 million gallons. The principal sources of ground water in the county are saprolite and fractured bedrock. Some wells in the vicinities of Heflin and Chulafinnee may yield 100 gal/min (gallons per minute) or more, but wells in other parts of the county generally yield 25 gal/min or less. Although large quantities of ground water are not available from individual wells, water sufficient for domestic and stock needs generally can be obtained. Water supplies adequate for small towns and light industries can be obtained from wells. Both surface water and ground water generally are of good chemical quality and suitable for most uses. Surface water is soft and low in dissolved-solids content. Ground water is generally soft and low in iron content; however, locally it ranges from moderately hard to very hard and contains more than 0.3 milligram per liter of iron. Total water use in the county in 1969 was about 1.6 Mgal/d, which is less than 1 percent of the water available. (Woodard-USGS)

W79-06322

8. ENGINEERING WORKS

8A. Structures

TV INSPECTION LOCATES LIBYAN WATER WELL PROBLEMS,
Underground Surveys Corp., Fresno, CA.
For primary bibliographic entry see Field 7B.
W79-06004

NEW LIFE FOR TERMINAL WELLS,
S. T. Guardino.
Pacific Groundwater Digest, Vol 2, No 2, p 19-23, February, 1979.

Descriptors: *Water wells, *Repairing, *Maintenance, Equipment, Inspection, Hydraulic equipment, Rupturing, Well screens, Clogging, Pumping tests, Rehabilitation.

Rising construction costs, limited availability of well sites, and environmental protection are three reasons for increased interest in water well maintenance and rehabilitation. Rehabilitation involves repair and/or redevelopment based on information obtained from visual inspection with a television log. Essential information includes structural condition, corrosion, encrustation, screen location, and location of reducers. The hydraulic sewage or forming tool is used to repair ruptures and overlapping perforations. Clogged screen and perforations can be cleaned with a variety of techniques. Each well should be carefully analyzed prior to employing any method. Well maintenance includes the well itself and the pumping unit. The amount and type of maintenance are dependent on the quality of the water. Regular treatment of wells which have encrustation problems will ensure continuous efficiency and prolong the well and pump life expectancy. A maintenance program should be determined with pumping tests to establish both pump and well performance, and water quality analyses. Water well drilling contractors would profit most by subcontracting with well maintenance and rehabilitation specialists. (Purdin-NWWA)
W79-06005

SOME SIMPLE SAND SOLUTIONS,
National Water Well Association Worthington, OH.
T. E. Gass.
Water Well Journal, Vol. 33, No. 3, p 36-37, March, 1979.

Descriptors: *Sand pumping, *Well filters, Well screens, Pipes, Water wells, Well development, Well rehabilitation, Clogging, Erosion.

Discharging of sand from wells penetrating layers of fine sand causes clogging of pipes and sprinkler irrigation lines. Coarse grained particles may damage screens and reduce well efficiencies. Sand passing through the pump erodes pump bowls and impellers, drastically shortening their performance life. Causes of sand pumping include: (1) improper selection of a slot size for the well intake; (2) localized enlargement of slot or screen openings, or holes in the casing due to corrosion or abrasion; (3) a broken or defective seal or packer; (4) settling and bridging of the gravel pack, which exposes parts of the natural formation; (5) inadequate well development; and (6) decomposition of borehole walls in uncased wells in sandstone aquifers. Solutions to the above problems are recommended bearing in mind that some cases of sand pumping may require more complex remedies. Improved design, construction and well development techniques will significantly reduce the incidence of sand problems. Many sandpumping wells can be rehabilitated to produce clear, sand-free water. (Purdin-NWWA)
W79-06012

LAMINATED WOOD FOR CASING OR SCREEN.
Canadian Water Well, Vol. 5, No. 1, p 18, February, 1979.

Descriptors: *Well casings, *Well screens, *Wood, Well construction, Cost.

A wood laminate, SBF-Obo, with high mechanical strength has been used successfully in deep wells in Europe and Africa. Well screens can be easily made with horizontal saw cuts in the casing with little loss in crushing strength. The cost is the same as steel casing but the light weight, 4 lb/ft for 6 inch casing and 25 lb/ft for 24 inch, gives added benefits in handling and storage. (Purdin-NWWA)
W79-06014

HERE'S HOW LINERS SAVED TWO PROBLEM WELLS,
Universal Oil Products, Inc., Saint Paul, MN. Johnson Div.
For primary bibliographic entry see Field 8C.
W79-06019

ECONOMIC ANALYSIS, ROOT CONTROL, AND BACKWATER FLOW CONTROL AS RELATED TO INFILTRATION/INFLOW CONTROL: APPENDICES,
American Public Works Association, Chicago, IL.
R. H. Sullivan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 052, Price codes: A07 in paper copy, A01 in microfiche. Report No. EPA-600/2-77-017b, December 1977. 145 p, 2 fig. 803151.

Descriptors: *Sewers, *Economics, *Publications, *Infiltration, *Abstracts, *Documentation, Information retrieval, Pipes, Design criteria, Cities, Construction materials, Manholes, Maintenance, Repairing, Rehabilitation Gates.

An adjunct is presented to a study conducted to identify and analyze the current practices for determining and controlling infiltration and inflow (I/I) and to investigate the role of roots and tide or backwater gates in the I/I problem. Literature abstracts concerning sewer infiltration studies, sewer design, flow measurement, new pipe material, pipe maintenance and repair, and pipe testing are presented in Appendix A. Appendix B contains the survey of the root control program questionnaire and includes the interviewers reports from Los Angeles, Los Angeles County, Sacramento, Denver, Austin, Dallas, Fort Worth, North Little Rock, St. Louis, Buffalo, Madison, Milwaukee and other cities. Appendix C contains the tide gate survey questionnaire and responses. (Davison-IPA)
W79-06100

COLLAPSE PRESSURE PREDICTION FOR THERMOPLASTIC WATER WELL CASINGS,
Auburn Univ., AL. Dept. of Civil Engineering.
D. York.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 665, Price codes: A06 in paper copy, A01 in microfiche. MS Thesis, December 1978, 107 p, 14 fig, 3 tab, 39 ref, append. OWRT A-059-ALA(1).

Descriptors: *Well casings, Plastics, Water wells.

This study analytically determined the collapse resistance of thermoplastic water well casings subjected to a linearly varying external pressure. The method used in the analysis was the principle of minimum potential energy, energy of the external loads, and the strain energy of the confining medium surrounding the casing. The collapse pressure prediction equation was developed in terms of casing geometry, external loading conditions, casing material properties, and surrounding soil or grout support. Parametric studies were conducted to evaluate the influence of these parameters on the predicted collapse pressure. Results indicate that the current method used in designing thermoplastic water well casings in some cases underestimates the collapse resistance of the casing.

W79-06108

THE BOTTOMLESS DAM,
Monash Univ., Clayton (Australia).
R. M. Phatarfod.
Journal of Hydrology, Vol. 40, No. 3/4, p337-363, February 1979. 6 tab, 26 ref.

Descriptors: *Dams, *Dam design, *Model studies, Mathematical models, Analytical techniques, Inflow, Storage, Reservoir storage, Discharge(Water), Reservoirs, Reservoir releases, Mathematics, Equations, Markov processes, Boundary processes.

The purpose of the work reported was to show that it is more fruitful to consider the bottomless (infinitely deep) dam as an approximation to the finite dam rather than the topless (infinitely high) dam considered hitherto. It was shown by taking a wide variety of input models that the theory for the former is far simpler, and the final results are in a form simple enough to give a quick estimate of the size of the reservoir required. (Sims-ISWS)
W79-06263

UPLIFT PRESSURES ON HOLLOW GRAVITY DAMS,
Roorkee Univ. (India). Water Resources Development Training Centre.
A. S. Chawla, and N. Mal.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY3, Proceedings Paper 14464, p 257-273, March 1979. 7 fig, 7 ref, 3 append.

Descriptors: *Uplift pressure, *Gravity dams, *Dam design, *Model studies, Mathematical models, Numerical analysis, Dams, Concrete dams, Joints(Connections), Drainage, Seepage, Loads(Forces), Engineering, Civil engineering, *Hollow gravity dams.

Closed-form solutions were obtained with the help of the Schwartz-Christoffel transformation for the determination of uplift pressures on hollow gravity dams. The uplift pressures were calculated numerically from the derived equations and plotted to facilitate the use of the results for design purposes. It was seen that uplift pressures along the joint between two monoliths drop almost linearly from the full-uplift pressure at the upstream face of the dam to zero uplift at the head of the cavity. The uplift along the center line of the monolith drops linearly to about less than 1/3 of the differential head at a point opposite the head of the cavity. Beyond this, the reduction in the uplift pressures was gradual. (Sims-ISWS)
W79-06264

UTILITY DISTRIBUTION SYSTEMS IN ICELAND,
Army Terrestrial Sciences Center, Hanover, NH.
H. W. C. Asmot.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A026 956, Price codes: A04 in paper copy, A01 in microfiche. Special Report, 1976. 63 p, 54 fig.

Descriptors: Foreign countries, Islands, Public utilities, *Water distribution(Applied), Electrical networks, *Sewerage, *Waste water treatment, *Municipal wastes, Pipes, Thermal water.

Reykjavikj's utility systems including water distribution, sewage collection, heat distribution, and electric transmission, are discussed. The sewage system consists of 203 miles of concrete pipes buried 4 ft underground. The lines are laid for gravity flow with outlet into the ocean. A primary treatment system has been proposed at a cost of $10-20 million over ten years. Clean water which needs no chlorination is drawn from wells 15 km east of the city and distributed through cast iron and polyethyelene pipes. The normal maximum water usage is 65,000 cu m/day. The electrical distribution system is described, as is the geothermal district heating and hot water system. (Small-FIRL)

W79-06337

ABATEMENT OF DEPOSITION AND SCOUR IN SEWERS,
Water Resources Engineers, Inc., Walnut Creek, CA.
M. B. Sonnen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 585, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-77-212, 1977. 114 p, 35 fig, 13 tab, 50 ref, 1 append.

Descriptors: *Design, Sewers, *Storm drains, *Combined sewers, Solid wastes, *Mathematical models, Conduits, *Pipe flow, Waste water treatment.

A new methodology is described for analyzing the design of storm and combined sewer systems. A review is presented of feasible methods for reducing the first-flush of solids in overflows from storm and combined sewers. These include increasing conduit slopes, providing cunette sections or other pipe shapes which maintain high velocity during low flow periods, providing upstream capture of solids during high flows, and providing increased treatment downstream. A mathematical model was developed which simulates the behavior of solids in pipelines as bedload, suspended load, or washload. The model is an adaptation of the EPA Storm Water Management Model. Sample analyses are given. The model can be applied to the design of total systems while considering the physical and economic factors of parts of the total system. (Small-FIRL)
W79-06369

EVALUATION OF BACKFLOW PREVENTION DEVICES: A STATE-OF-THE-ART REPORT,
National Bureau of Standards, Washington, DC.
G. C. Sherlin, and R. W. Beausoliel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-260 913, Price codes: A07 in paper copy, A01 in microfiche. Final Report, 1976. 137 p, 5 fig, 20 tab, 38 ref, 1 append.

Descriptors: Potable water, Performance, *Pipe flow, Piping systems(Mechanical), *Flow control, Flow characteristics, *Standards, *Testing, *Reliability.

The state-of-the-art of backflow prevention devices was reviewed. A systematic review of the literature is presented along with reports of consultations with water purveyors, plumbing officials, laboratory officials, and field researchers. Effective devices, test methods, and laboratory practices are considered. Existing backflow prevention devices provide protection against backflow, however not enough data exists to quantitatively establish effectiveness. None of the existing devices is fool proof. A. S. S. E. Standards are the only standards that have definitive test procedures and test setups. The test methods could be improved by the use of realistic service condition simulation. Tests on the reliability of devices, functional performance tests, and development of a fail-safe indicator are recommended. (Small-FIRL)
W79-06378

8B. Hydraulics

SOLAR IRRIGATION PROGRAM - STATUS REPORT, OCTOBER 1976 THROUGH JANUARY 1977,
Sandia Lab., Albuquerque, NM.
R. L. Alvis.
Available from the National Technical Information Service, Springfield, VA 22161 as SAND-77-0380, Price codes: A04 in paper copy, A01 in microfiche. Report SAND-77-0380. 1977. 66 p, 43 fig, 11 ref.

Descriptors: *Irrigation, Irrigation engineering, *Costs, *Energy, Performance, *Pump testing, Deep wells, New Mexico, Arizona, *Heat transfer.

Progress made by the ERDA solar irrigation program from October 1976 through January 1977, is discussed. The program, which initially consisted of a shallow well experiment under construction in NM, has been expanded to include a deep well experiment in AZ and a follow up demonstration system. Technical discussion of the shallow well experiment is emphasized. The solar collector field, 6710 sq ft aperture area, heats a heat transfer fluid (Exxon Caloria HT 43). When the heat transfer fluid exits the collector field, it is recirculated if its temperature is below 420F. If above 420F, the fluid is sent either to the heat engine or thermal storage. The heat engine either takes heated oil from storage or from the collectors and heats its working fluid by use of a boiler and fluid pump. The working fluid is expanded through a turbine. Cost effectiveness for the solar pump was calculated as a function of the Rankine cycle engine efficiency. Minimum system cost occurs at an engine cycle efficiency between 15% and 16%. The cost of purchasing and installing a new irrigation system in the isolated Estancia Valley of NM is estimated to be $50,000. If solar collectors cost about $5/sq ft, solar would be competitive if natural gas cost $5 mcf for a system operating more than 2200 hr/yr, electricity cost $.10/kWh for a system operating 1900 hr/yr, and diesel cost $.55 gal at 2600 hr/yr. (Small-FIRL)
W79-06362

SOLAR IRRIGATION PROGRAM PLAN REVISION,
Sandia Labs., Albuquerque, NM.
R. L. Alvis, and S. C. Vandevender.
Available from the National Technical Information Service, Springfield, VA 22161 as SAND-770730, Price codes: A03 in paper copy, A01 in microfiche. Report SAND 77-0730, 1977. 34 p, 4 fig, 6 ref.

Descriptors: *Irrigation, Irrigation engineering, Pumps, *Pump testing, Energy, *Solar radiation, New Mexico, *Deep wells, Arizona, *Pilot plants.

The ERDA solar irrigation program plan is updated through fiscal year 1979. Construction of the experiment in the Estancia Valley, NM is planned. The system will begin operation, data will be collected, and complete performance calculations will be made. New Mexico State University will plan and design the optimum utilization of off-season energy. Studies will be performed to upgrade the system to power a low energy center pivot system. A study will be initiated to determine the potential market for solar powered irrigation. A deep well experiment will be conducted in AZ. Also, an international workshop is planned to disseminate the results of the first season of operation. (Small-FIRL)
W79-06363

EVALUATION OF BACKFLOW PREVENTION DEVICES: A STATE-OF-THE-ART REPORT,
National Bureau of Standards, Washington, DC.
For primary bibliographic entry see Field 8A.
W79-06378

STORMWATER RUNOFF ON URBAN AREAS OF STEEP SLOPE,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
B. C. Yen, V. T. Chow, and A. O. Akan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 755, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-77-168, 1977. 91 p, 28 fig, 10 tab, 48 ref, 3 append.

Descriptors: *Mathematical models, *Storm runoff, *Urban runoff, *Slopes, *Runoff forecasting, Hydraulic engineering, Hydraulics.

The applicability of commonly used urban storm runoff prediction models to drainage basins with steep slopes was investigated. The hydraulics of runoff on steep slope areas was reviewed, and how it differs from that of mild slope areas was discussed. Also, the difficulties in applying commonly used methods to steep slope basins were presented. It appears that engineers may not be familiar with the problems associated with steep slope areas and may not realize that numerical results given using conventional methods may not be reliable. A simple method for steep slopes was proposed, and an example utilizing data from the Baker Street Drainage Basin in San Francisco, is provided. (Small-FIRL)
W79-06380

8C. Hydraulic Machinery

CAUSES AND EFFECTS OF 3-PHASE POWER UNBALANCE.
Water Well Journal, Vol. 33, No. 3, p 54-55, March, 1979. 1 tab.

Descriptors: *Pumps, *Electric motors, Installation, Electric currents, Electrical equipment, Safety, Water wells.

The problem of unbalanced electrical loads to submersible pump motors is discussed. A step-by-step procedure is outlined for proper pump installation. A chart is provided which matches motor KVA with motor horsepower. A simple method of calculating the percent of current unbalance is used for three examples of motor hookups. The hookup with the lowest percentage of current unbalance will result in maximum motor efficiency. The percentage of current unbalance should not exceed 5%. (Purdin-NWWA)
W79-06009

HEAT PUMP UPDATE,
National Water Well Association, Worthington, OH.
D. Bacon.
Water Well Journal, Vol. 33, No. 3, p 70, March, 1979. 1 tab.

Descriptors: *Heat pumps, *Cost comparisons, *Efficiencies, Heating, Economics, Ground water.

The Coefficient of Performance (COP) and operating cost of a demonstration ground water heat pump are compared with the air-to-air heat pump and other conventional heating systems for the months of November and December, 1978. The ground water heat pump had a COP of approximately 3.0, meaning that it produced three times more energy than it consumed. This resulted in a saving of 33% over the air-to-air heat pump for the specified months. Comparative data was accumulated for the central Ohio area. (Purdin-NWWA)
W79-06010

BASIC PERFORMANCE FACTORS OF CENTRIFUGAL PUMPS.
Water Well Journal, Vol. 33, No. 3, p 61-63. March, 1979.

Descriptors: *Centrifugal pumps, *Performance, Pressure head, Capacity, Horsepower, Curves, Pump testing, Efficiencies, Water wells.

Four factors which determine the performance of centrifugal pumps are: head or pump pressure; capacity it delivers; horsepower it requires; and efficiency. Pump head is usually given in terms of how many feet of water it can support. Total pressure is the sum of static pressure and motion pressure or velocity head. Capacity is the number of gallons per minute a pump will deliver. Centrifugal pumps depend on three types of horsepower: water, brake, and wire-to-water. Formula for the derivation of each type are given. Pump performance is shown through the use of performance curves. Head-capacity curves and horsepower curves must be determined from pump tests. A formula to calculate the pump efficiency curve is given. When pumping rpm is changed, effects can be calculated by using affinity laws which state that: pump capacity changes directly with speed; head changes with the square of the pumping rpm; and brake horsepower changes with the cube of pumping rpm. (Purdin-NWWA)
W79-06011

HERE'S HOW LINERS SAVED TWO PROBLEM WELLS,
Universal Oil Products, Inc., Saint Paul, MN. Johnson Div.
P. H. Muller.
Pacific Groundwater Digest, Vol. 1, No. 2, p 47-49, February, 1979.

Descriptors: *Water wells, *Liners, Well casings, Well screens, Corrosion, Sands, Clogging, Incrustation.

Guidelines are provided for sizing liner OD, liner-casing annulus, gravel pack, and pump. Advantages of using continuous slot screens in liners are that extra drawdown is reduced and acidizing will more effectively remove incrustations in areas of hard water. Two case studies of successful use of liners in saving corroded wells and eliminating sand pumping are discussed. Not every well can be saved by a liner, however. In some cases, a badly sanding well will choke off the water so the sand clogs the original perforations. (Purdin-NWWA)
W79-06019

8D. Soil Mechanics

UTILIZATION OF SEWAGE SLUDGE FOR TERRAIN STABILIZATION IN COLD REGIONS,
Army Terrestrial Sciences Center, Hanover, NH.
D. A. Gaskin, W. Hannel, A. J. Palazo, R. E. Bates, and L. E. Stanley.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A047 368, Price codes: A03 in paper copy, A01 in microfiche. Special Report 77-37 November 1977. 38 p, 29 fig, 13 tab, 6 ref, append.

Descriptors: *Erosion control, *Soil stabilization, *Sewage sludge, *Vegetation establishment, *Nutrients, Moisture content, Runoff, Cold regions, New Hampshire, Waste water, Sludge disposal, Municipal wastes, Fertilizers.

Fourteen test plots were established in Hanover, New Hampshire to evaluate the effectiveness of sewage sludgeand primary effluent in the stabilization of terrain in cold regions. The plots were 10 by 40 ft with individual 350 gal tanks to collect sediment and were located at an angle of 16 degrees. Variables in 13 of the plots were: the nutrient source as fertilizer, sludge, or primary effluent; moisture as irrigation and nonirrigation; erosion control material as jute netting, straw with tacking compound, and no erosion material; and vegetation, three grasses and two legumes. The control plot lacked fertilizer, seed, and erosion control material. Results of the study indicated that the erosion control measures had an efficiency of 89.6-99.8%, based on a soil loss from the control plot of 34,531 lb (dry weight)/acre. Sludge was found to act as both a nutrient source and an erosion control material and reduced runoff velocity and absorbed moisture. When soil loss was considered a function of the nutrient source, sludge-treated plots lost an average of 150 lb soil/acre, fertilized plots lost 814 lb/acre, and primary effluent treated plots lost 981.7 lb/acre. (Lisk-Firl)
W79-06342

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

AN ANNOTATED BIBLIOGRAPHY ON RIVER RECREATION.
North Central Forest Experiment Station, St. Paul, MN.
For primary bibliographic entry see Field 6B.
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ECONOMIC ANALYSIS, ROOT CONTROL, AND BACKWATER FLOW CONTROL AS RELATED TO INFILTRATION/INFLOW CONTROL: APPENDICES,
American Public Works Association, Chicago, IL.
For primary bibliographic entry see Field 8A.
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Effects of Ocean Dumping Activity Mid-Atlantic Bight - 1976 Interim Report,
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ENVIRONMENTAL PROTECTION AGENCY, ATLANTA, GA. REGION IV.
Final EIS Greensboro-Guilford County, N.C. 201 Wastewater Treatment System Project No. C37037601.
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ENVIRONMENTAL PROTECTION AGENCY, CHICAGO, IL. WATER DIV.
Environmental Assessment Guidance Municipal Sewage Treatment Works Program.
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Report on the Plant Evaluation at Old Faithful Wastewater Treatment Plant Yellowstone National Park,
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ENVIRONMENTAL PROTECTION AGENCY, DENVER, CO. SURVEILLANCE AND ANALYSIS DIV.
Virgin River Study--Utah: March, 1976,
W79-06423 5A

ENVIRONMENTAL PROTECTION AGENCY, GROSSE ILE, MI.
Mathematical Modeling Strategies Applied to Saginaw Bay, Lake Huron,
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ENVIRONMENTAL PROTECTION AGENCY, RESEARCH TRIANGLE PARK, NC. OFFICE OF AIR QUALITY PLANNING AND STANDARDS.
Control of Refinery Vacuum Producing Systems, Wastewater Separators and Process Unit Turnarounds,
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ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, DC. MUNICIPAL CONSTRUCTION DIV.
Cost Estimates for Construction of Publicly-Owned Wastewater Treatment Facilities. Volume 2. Summaries of Technical Data Categories I-IV. 1976 Needs Survey,
W79-06324 5D

ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, DC. OFFICE OF SOLID WASTE.
Landfill Disposal of Hazardous Wastes; A Review of Literature and Known Approaches,
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ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, DC. OFFICE OF WATER PROGRAM OPERATIONS.
Cost Estimates for Construction of Publicly-Owned Wastewater Treatment Facilities, 1976 Needs Survey. Volume 1,
W79-06323 5D

ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, DC. WATER PLANNING DIV.
Modeling and Decision-Making Aspects of Water Quality Management,
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ENVIRONMENTAL PROTECTION SERVICE, BURLINGTON (ONTARIO). WASTE WATER TECHNOLOGY CENTRE.
Acute Lethality of Wastewater Disinfection Alternatives to Juvenile Rainbow Trout (Salmo Gairdneri),
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ESSO S.A.P.A., ARGENTINA.
Criteria of Water Quality in Relationship with the Final Use of the Receiving Body and Its Assimilation Capactiy (Criterios de calidad del agua en relacion con el uso final del cuerp receptor y su capacidad de asimilacion),
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Hydrologic Data for Urban Studies in the Dallas, Texas Metropolitan Area, 1976,
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GEOLOGICAL SURVEY, BATON ROUGE, LA. WATER RESOURCES DIV.
Water Resources Data for Louisiana, Water yar 1978--Volume 1. Central and Northern Louisiana.
W79-06305 7C

Water Resources Data for Louisiana, Water year 1978--Volume 2. Southern Louisiana,
W79-06306 7C

Water Resources Data for Louisiana, Water year 1978--Volume 3. Coastal Louisiana,
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GEOLOGICAL SURVEY, BOSTON, MA. WATER RESOURCES DIV.; AND VERMONT AGENCY OF ENVIRONMENTAL CONSERVATION. DEPT. OF WATER RESOURCES.
Ground-Water Resources of the Upper Winooski River Basin, Vermont,
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Applications of Recursive Estimation Techniques to Time Variable Hydrological Systems,
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Determination of the Mechanism of Recharge in the Los Naranjos Area in Mexico Using Environmental Isotope Techniques,
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INTERNATIONAL JOINT COMMISSION-UNITED STATES AND CANADA, WINDSOR (ONTARIO). GREAT LAKES WATER QUALITY BOARD.
Great Lakes Water Quality Sixth Annual Report. Appendex F. Report on Hazardous Waste Disposal.
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Numerical Modelling of an Aquifer System with Intermittent Recharge,
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Conceptual Framework for Coordinated Great Lakes Monitoring,
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Lagrangian Surface Current Measurements on the Outer Continental Shelf,
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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, SEATTLE, WA. PACIFIC MARINE ENVIRONMENTAL LAB.
Transport Mechanisms and Hydrocarbon Adsorption Properties of Suspended Matter in Lower Cook Inlet,
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Ross Ice Shelf Sea Temperatures,
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Microsetella Norvegica (Boeck): A Direct Relationship Between Seasonal Sea Temperature and Adult Size in a Planktonic Copepod,
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The Watershed Influence on Storm Runoff in Small Norwegian Rivers,
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Effect of Drainage System Design and Operation on Nitrate Transport,
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NORTH CAROLINA STATE UNIV. AT RALEIGH. WATER RESOURCES RESEARCH INST.
Southeast Conference on Legal and Administrative Systems for Water Allocation and Management, Virginia Polytechnic Institute and State University, Blacksburg, April 19-20, 1978.
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Legal Aspects of Flood Plain Management,
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An Annotated Bibliography on River Recreation.
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Beneficial Disposal of Water Purification Plant Sludges in Waste-Water Treatment,
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NORTHERN ILLINOIS UNIV., DE KALB. DEPT. OF GEOLOGY.
Miocene Glaciomarine Sediments from Beneath the Southern Ross Ice Shelf, Antarctica,
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Fabrication of Smooth Tubes for Large Multistage Flash Evaporator Desalination Plants,
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An Analysis of the Feasibility of Separating Exploration from Production of Oil and Gas on the Outer Continental Shelf.
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OFFICE OF WATER RESEARCH AND TECHNOLOGY, WASHINGTON, DC.
Bibliography of Membrane Technology Pertaining to Saline Water Desalination.
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Conversion of Saline Water: A Bibliography of Literature Resulting from the Activities Sponsored by the Office of Saline Water.
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Theoretical and Practical Aspects of the Evaluation of Candidate Reverse Osmosis Membranes for Desalination,
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Geographic-Economic Aspects of Pollution Control Systems,
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Studies of Flocculation and Sedimentation Treatment of Pulp Mill Effluent. (Part 2). An Approach of a Closed System Using Ettringite Compounds, (In Japanese),
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Chrysotile Asbestos Dilution Studies,
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Nitrification of a Secondary Municipal Effluent Using a Rotating Biological Contactor,
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Characteristics of Effluents from Separate Septic Tanks Treating Grey Water and Black Water from the Same House,
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Pilot Plant Studies of Biological Treatment of Magnesium-Base Sulfite Mill Effluent--Aerated Stabilization Basin and Rotating Biological Surface,
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Growth, Food Conversion and Survival of O-Group English Sole (Parophrys Vetulus Girard) at Five Temperatures and Five Rations,
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The Survival of Embryos of the Annual Fish Nothobranchius Guentheri Exposed to Temperature Extremes and the Subsequent Effects on Embryonic Diapause,
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Industrial Wastewater Recirculation System: Preliminary Engineering,
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Initial Effects of Clearcut Logging on Size and Timing of Peak Flows in a Small Watershed in Western Oregon,
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Adsorption and Extractability of Molybdenum in Relation to Some Chemical Properties Soil,
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Complying with the Flood Disaster Protection Act,
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A Rapid Method for Estimating the Nitrogen-Supplying Capability of a Soil,
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The Microeconomics of Water Supply and Demand in the Northeastern United States,
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Derivation of the Probability Density Function of Certain Biased Samples of Coarse Riverbed Material,
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Complementarity of Thermoregulatory Rhythms in Micropterus Solmoides and M. Dolomieui,
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Research on and Development of Ion-Selective and Ion-Specific Membranes for Use in the Large-Scale, Low-Cost Demineralization of Saline Waters by Selective Electrodialysis.
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Feasibility Study on In-Sewer Treatment Methods,
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W79-06496	5C
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W79-06500	5C

ABSTRACT SOURCES

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A. CENTERS OF COMPETENCE		
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Cornell University, Policy Models for Water Resources Systems	W79-06001 06166--06186	22
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C. OTHER		
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